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GREEN STAIN

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THE subject of green stain has received very little consideration in comparison with the vast amount of research which has been done on other phases of dental pathology. It seems incredible that a condition as common as this could have been passed over so lightly by dental scientists. The problem of caries has, of course, been the predominating interest, and rightly so, but, when that field is left, the attention of the workers has been focused in so many different directions that there remain a vast number of unexplained dental phenomena. Green stain is one of these.

For a while, during the last decade of the nineteenth century, interest in the etiology of this condition was stimulated through the researches of Dr. Ottolengui, followed by those of W. D. Miller, and soon after by those of Carl Theodore Gramm, W. C. Barrett and S. B. Palmer. The investigations made by them were all reported in the years 1892 to 1895 inclusive. Since that time, little has been done toward continuing the work. One finds that nearly all discussions on green stain have since 1895 been based upon the articles written by these men.

From somewhere, probably through the dental textbooks, the theory has developed that green stain occurs where there are remnants of Nasmyth's membrane. Probably the great majority of dentists would, if questioned, reply that the enamel cuticle plays an important part in the formation of this particular type of stain. The idea no doubt hinges on the fact that green stain predominates about the necks of newly erupted teeth where bits of this membrane may persist.

For my part, it is impossible to understand how the problem could be dropped at this point when there is still so much controversy as to the origin, structure, longevity and function of the membrane in question.

In 1839, Nasmyth first showed that by treatment with acids, a delicate membrane could be separated from the coronal surface of the newly erupted tooth.[1] Since that time, many have engaged in the study of "Nasmyth's membrane." There is but little agreement as to its duration.

According to Lewis (1914) and others, it is destroyed soon after eruption. Von Ebner (1922) says that it is found on little used teeth. Beretta (1914), Hopewell-Smith

From the Forsyth Dental Infirmary.

(1918), Walkoff (1924) and others claim that it remains throughout the life of the tooth, at least on parts little exposed to wear.[1]

In 1926, Samuel Wood Chase wrote a monograph in which he said:

Nasmyth's membrane is a vestigial, transitory structure, in the majority of cases destroyed during the early stages of eruption, and is probably never found any considerable time after eruption is completed. Since this is so, it is absurd to attempt to ascribe any function to it.[1]

Endelman and Wagner, in their "General and Dental Pathology," give this explanation:

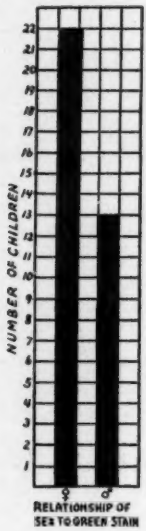

Figure 1.

The cells of the external layer, after the cells of the stellate reticulum have atrophied, coalesce with those of the internal layer and persist for some time after the eruption of the teeth as Nasmyth's membrane.[2]

Eugene S. Talbot (1920) believed that the external epithelial layer remains until the tooth erupts and the crown passes through it and the sac wall.[3] Rosse, in 1923, suggested that perhaps the function of this structure was to protect the tooth against extraneous harmful agencies, for, according to him, it had not been satisfactorily demonstrated that the organic matrix of the membrane could be disintegrated by the action of bacteria.[4]

In the light of such conflicting views, how can one blithely attribute the occurrence of green stain to the persistence of Nasmyth's membrane and forget the matter?

Considering the presence of the enamel cuticle as a predisposing factor, investigators have explained the actual formation of the green coloring in several ways. Most of them have observed that the stain is most frequently seen on the teeth of young people and of adults who pay

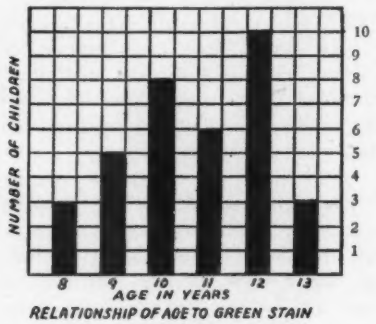

Figure 2.

scant attention to the cleanliness of their mouths.

Others, Miller[5] and Fones[6] for instance, say that in unclean mouths, the gums are usually irritated and bleed easily. In bleeding, the coloring matter or hemoglobin (sulfomethemoglobin, according to Miller) of the blood is attacked by bacteria and the resulting decomposition causes the green discoloration.

Others have thought that it was not a gingival hemorrhage, but the action of chromogenic bacteria which brought about this condition. Among the organisms which have been thought to be at fault are: *Leptothrix buccalis, Micrococcus viscosus, Staphylococcus viscosus,*

Penicillium glaucum, the aspergilli, *Bacillus liquefaciens fluorescens motilis, Bacillus pyocyaneus* and *Bacillus fluorescens non-liquefaciens.* Those writers who hold to the Nasmyth membrane theory think that these chromogenic mouth bacteria attach themselves to the remnants of the membrane, produce the green coloring and cause, by the formation of acids, a softening and disintegration of the polished surface of the enamel which leads to decay.[7] Other investigators accept the theory of Burchard and Inglis, who state that:

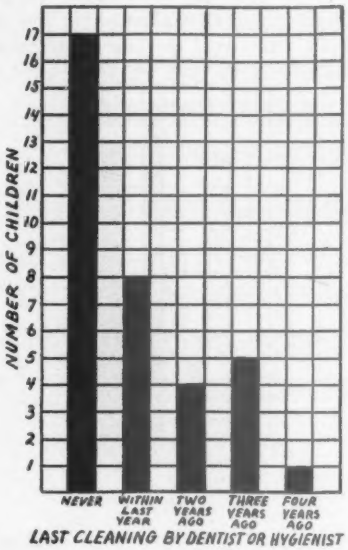

Figure 3.

If cases be observed early in childhood, it will be noted that green stain is usually preceded by a lack of oral hygiene; collections of food débris are not removed from about the necks of the teeth, which implies that prior to the formation of green stain the affected enamel surfaces have been subjected to the action of fermenting food débris—that is, to acids. These facts have led to the belief that the roughness or decalcification has preceded the green deposits.[5]

McBride[8] suggests that perhaps the general health of the child may be a factor to consider in the study of green stain. He does not, however, enlighten us as to just what relationship there may exist between the two.

Years ago, Miller stated that he had been unable to find any connection between a milk diet and green stain.[5] His remark apparently put a stop to investigation from this point of view.

I have examined the mouths of a number of children with green stain at the Forsyth Infirmary and have questioned them on certain points which I felt might have some bearing on the problem. Their case histories were recorded on blanks prepared for the purpose, and eventually the results were tabulated. The examination was of such nature that it could be made in less than ten minutes at the dental chair. Only clinical aspects of the condition were considered, no attempt being made to obtain smears of the stain for bacteriologic or chemical study, nor to subject the children to any sort of routine physical examination. They were questioned as to their age, nationality, customary care of the mouth, general health and usual diet. The mouth examination included a recording of the occlusion, missing teeth, susceptibility to caries,

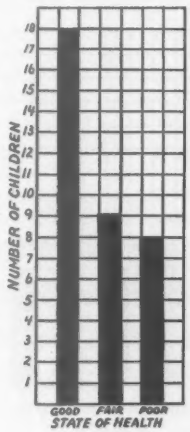

Figure 4.

filling materials used and types of cavities and fillings present according to the Black classification. The examination of the stain itself consisted of a description of the color, shape, extent and location of the stain, as well as observation of the condition of the enamel in the area covered by the stain.

Case histories were taken in any cases of green discoloration present at a time when the examination could be made. There was no selection of cases in order to "prove" certain points. The only requirements were that the stain be unquestionably green and that the time available be sufficient to investigate all points listed on the case history blank.

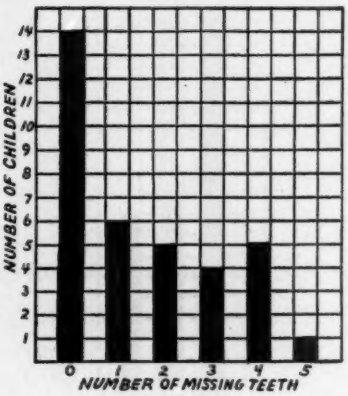

Figure 5.

Of the thirty-five children observed, twenty-two, or 62.8 per cent, were girls, and thirteen, or 37.1 per cent, were boys. In view of the fact that the two groups were about equally diligent in the care of the mouth, it would seem that perhaps there is a difference in the ability of the two sexes to withstand the formation of green stain. (Fig. 1.) Further inquiry into this phase of the subject seems advisable.

From the standpoint of age, there seems to be a greater amount of green stain present during the tenth, eleventh and twelfth years than in years preceding or following that period. Since these are rather turbulent years for both sexes, it may be that the approach to puberty affects the resistance to this condition just as to other types of bacterial attack on the body. It is well known, for instance, that, during their lives, individuals pass through varying stages of immunity and susceptibility to caries. Might it not be that a similar situation obtains in the case of green stain, the increased drain on all resources of the body during those years rendering one more prone to the development of the stain? Three of the children, or 8.5 per cent, were in their eighth year; five, or 14.2 per cent, were in their ninth year;

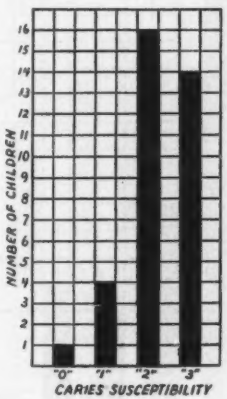

Figure 6.

eight, or 22.8 per cent, were 10 years old; six, or 17.1 per cent, were 11; ten, or 28.7 per cent, were 12, and three, or 8.5 per cent, were 13. (Fig. 2.)

Apparently, nationality is not a predisposing factor. Green stain was observed in the mouths of children of varying descent as may be noted from the following list:

Irish	14 children
American	5 children
Italian	3 children
Syrian	3 children
Polish	2 children
French-Irish	2 children

Spanish-Irish	1 child
French Canadian	1 child
Russian Jew	1 child
French	1 child
German	1 child
Canadian-English	1 child

The fact that 40 per cent of the children in this study were Irish must not be allowed to bear too much weight. In Boston, where these observations were made, more than 80 per cent of the inhabitants are Irish or of Irish descent. It is, therefore, to be expected that the largest number of children coming to the clinic would be of this nationality.

In order to obtain some idea of the usual care which these children gave their mouths, they were questioned as to how often they brushed their teeth, and the kind of dentifrices they used, and they were asked whether they had ever had their teeth cleaned by a dentist or a hygienist. Eight children, five boys and three girls, reported that they never used a toothbrush. Seven said they usually cleaned their teeth once a week. One child used a brush twice a week. Two children brushed their teeth three times a week. This means that more than half the group averaged less than one brushing a week. Needless to say, this is not in accord with the prevailing theory that all but the rare immune-to-caries person should use a toothbrush after every meal. The other seventeen children gave varying reports ranging from four to twenty-one times a week.

There were thirteen different types of dentifrices mentioned by the twenty-five children who could remember what kind they used. Most of the varieties had only one or two users, but eight, or 32 per cent of the twenty-five, indicated a preference for Dr. Lyons tooth powder. Whether this fact is of any importance, I am not in a position to say.

When asked whether they had ever had their teeth cleaned by a dentist or hygienist, seventeen, or 48.5 per cent, answered no. The other eighteen had had the teeth cleaned within the last four years, and one of these, a girl, said that she had had hers cleaned just two

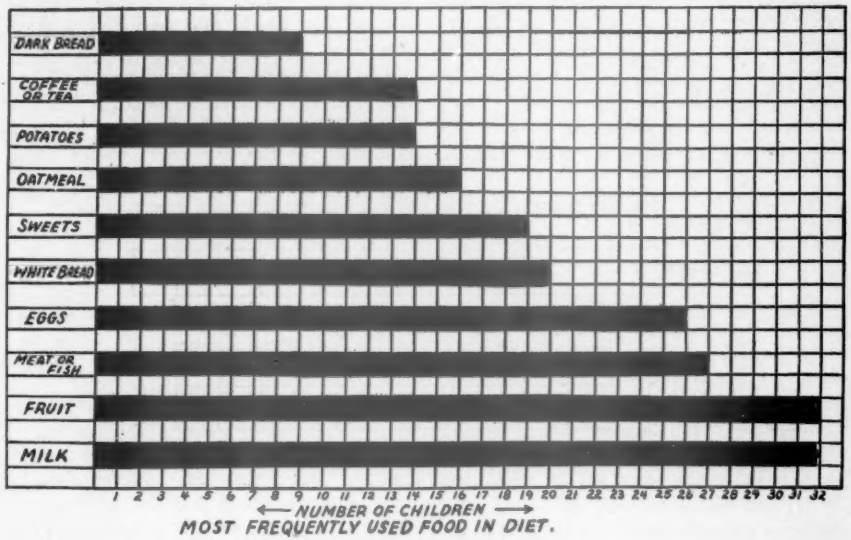
DARK BREAD
COFFEE OR TEA
POTATOES
OATMEAL
SWEETS
WHITE BREAD
EGGS
MEAT OR FISH
FRUIT
MILK
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
← NUMBER OF CHILDREN →
MOST FREQUENTLY USED FOOD IN DIET.

Figure 7.

months previously. Her upper anterior teeth were badly bunched and her mouth was dirty, although she reported that she used a toothbrush at least three times a week. Her gums were slightly inflamed and swollen and bled rather easily. In my opinion, hers might possibly be a case in which the hemoglobin from the escaping blood played a part in the production of the green stain. (Fig. 3.)

The general state of each child's health was determined by asking whether he was sick very much and whether he was often absent from school and by observing his coloring and his general physical appearance. On this basis, the children were tabulated as having "good," "fair" or "poor" health. Eighteen, or 51.4 per cent, were apparently in "good" health. Nine, or 25.7 per cent, had "fair" health, and eight, or 22.8 per cent, had "poor" health. To me, this would indicate that the health of the child has little to do with the development of green stain, for those who were in good health were about numerically equal to those who were not, and they all had green stain. (Fig. 4.)

A check-up on the occlusion of each child, using Angle's classification, showed that seven children had what could be called normal occlusion; sixteen had first permanent molars which were in Class I relationship; five had molars in Class II relationship, and the remaining seven had molars which were in Class III relationship. This is not nearly so striking as the fact that of those children who had definite malocclusion, thirteen showed abnormalities in the anterior region which could very easily hinder the cleansing of these teeth by the normal excursions of food over their surfaces during mastication. Of these thirteen children, five had spaced upper anterior teeth; four had bunched upper anterior teeth; two had protruding upper anterior teeth, as a result of thumb-sucking; one had an open-bite (due to tongue-thrusting), and one had a deep overbite.

On inspection, the gingivae of all but five children seemed to be in a healthy state. The description of the gingival condition in the five cases varied from "slightly reddened" to "red and swollen." In view of the fact that thirty, or 85.7 per cent, of the children showed no gingival disease, one hesitates to attribute all green stain to bleeding of the gums and its sequelae.

Because the fact that there were teeth missing might be conducive to the formation of green stain through interference with normal masticatory cleansing of the remaining teeth, a record was made of all teeth which were not present at the time of the examination with the exception of the second and third molars. No attempt was made to determine whether such teeth were congenitally missing or as yet unerupted or had been extracted,

	Right				PERMANENT					Left		
	1st Molar	2nd Bicusp	1st Bicusp	Cuspid	Lateral	Central	Central	Lateral	Cuspid	1st Bicusp	2nd Bicusp	1st Molar
UPPER	2	2	1	9	29	35	35	31	8	2	2	1
LOWER	1	1	2	2	6	7	8	7	1	1		

	Right			DECIDUOUS				Left		
	2nd Molar	1st Molar	Cuspid	Lateral	Central	Central	Lateral	Cuspid	1st Molar	2nd Molar
UPPER		3	9					6	2	
LOWER	1	1	2					2	1	1

FREQUENCY WITH WHICH STAIN APPEARED ON EACH TYPE OF TOOTH

Figure 8.

since this seemed an irrelevant point. Fourteen, or 40 per cent, of the thirty-five children had no missing teeth. One child lacked five teeth and the other twenty children were rather evenly divided into groups having one, two, three or four teeth missing. A total of forty-nine teeth were not in place and of these only eight were anterior teeth. They were all cuspids, five being conspicuous by their absence in the upper jaw and three in the lower jaw. Since most green stain appears on anterior teeth, the lack of teeth in the posterior regions would probably not be an important factor in its production. Moreover, in view of the fact that only six of the thirty-five children were found to have missing anterior teeth, it does not seem that their absence had anything to do with the green discoloration. (Fig. 5.)

In order to obtain some idea of the susceptibility of these children to caries, their case history blanks were marked "0," "1," "2" or "3," to indicate "no cavities, and/or fillings," "a few," "a good many" or "a large number" of them. Only one child was found eligible for the "0" grouping. Four, or 11.4 per cent, had a few cavities and/or fillings; sixteen, or 45.7 per cent, had a good many, and fourteen, or 40 per cent, had a large number of them. Since all but five of the children were quite susceptible to caries, it would seem that green stain and caries are frequently associated. They may, however, be two unrelated states which are influenced by the same conditions; i.e., age, general health, oral hygiene, diet, etc. (Fig. 6.)

The usual types of filling materials were found in these mouths, but amalgam was by far the most common, thirty-three, or 94.2 per cent, of the children having good, bad or mediocre amalgam fillings. Notwithstanding the large percentage of this material which was in evidence, I am inclined to believe that its use is not a factor in the development of green stain. My opinion is based upon the fact that most of the dental work was so recent that it could scarcely have been in the mouth long enough to have caused the condition. Twenty-two of the children had been initiated into the mysteries of dental care only a short time before these observations were made.

Most persons are of the opinion that if cavities develop beneath green stain, they will be of the Black Class V, or gingival one-third, type. Fully expecting to find this to be true, I made a tabulation of all classes of cavities and fillings which were present in each mouth. Naturally, the pit and fissure cavities and those found on the proximal surfaces of bicuspids and molars were by far the most common, but their presence could not be attributed to the green stain. The interesting point is that seventeen, or 48.5 per cent, of the mouths were found to have either fillings or cavities on the proximal surfaces of the anterior teeth, whereas in only five mouths could gingival cavities be found. This may indicate that (1) the stain acts as a protective agent and prevents attack of caries organism on the labiogingival enamel or (2) the stain extends onto the proximal surfaces, is sheltered there and, through the action of its own particular type of bacteria, brings about a decalcification of the underlying enamel, thereby making it more liable to assault by the bacteria of caries. This needs further investigation.

Each child was asked what he usually had to eat during the course of a day and, from the replies obtained, a chart was made showing what foods were most common in the diets of these children. From it, one may note that milk and fruit were used, at least to some extent, by thirty-two, or 91.4 per cent, of the children. Meat or fish and eggs follow in popularity, with twenty-seven and twenty-six children, respectively, using these foods. Twenty of them ate white bread, whereas only nine ate dark bread. Nineteen, or 54.2 per cent, ate sweets in

one form or another. Oatmeal had sixteen adherents, while "wheaties," "cornflakes," "wheatena," "Ralston's" and sundry other breakfast cereals had only two or three consumers each. Fourteen children mentioned potatoes as a food commonly used at home and a like number said that they frequently drank tea or coffee. Other foods were mentioned, but none sufficiently often to warrant being included in the accompanying chart. (Fig. 7.) From the data given in it, one can well see that the common use of milk in the diets of most children might be considered a factor in green discoloration of the teeth. As has been mentioned, when W. D. Miller announced that he had been unable to establish any relationship between green stain and a milk diet, investigation of this subject from the food angle apparently ceased. I am unable to say whether it would be possible for any of the above-mentioned foods to play an important rôle in the formation of this coloring, but I do feel that it is a point worthy of consideration.

The stains themselves ranged from dark to light green, with six or seven intermediate colors easily distinguishable. Usually, the blackish or brownish green stains were more condensed and covered less of the tooth surfaces in a gingivo-incisal direction, whereas the lighter gray greens, grass greens and yellow greens were a little less condensed and more apt to cover a greater amount of the labial surface, and quite frequently had superimposed a soft, fuzzy yellow or gray débris. It seems to follow that the lighter the stain, the more filthy would be the general mouth condition, and the reverse was true of the darker stain. The two types are about equally common, fifteen cases being found with the darker variety and twenty with the lighter type. It would probably be well to remark at this time that the so-called "darker stain" was not what is usually known as black stain. To repeat, all stains discussed herewith were definitely green.

The shapes of these stains varied considerably. Some were smeared. Some were but a curved line, thin or wider, which followed the contour of the labio-gingival crest. Streaks running gingivo-incisally might be combined with either of these types. When this occurred, one could usually find that the enamel was slightly corrugated and that the stains followed these corrugations. In a few instances, three to be exact, only the streaks of green stain were to be found.

There was a wide range in the amount of tooth structure covered by the stain. All possible varieties, from a thin line to a complete covering of the entire labial surface, were seen. In a few mouths, more than one width of stain could be observed. In recording data, this fact was taken into consideration and, as a result, there were thirty-nine, rather than thirty-five, different entries made with regard to this characteristic. The following listing shows the frequency with which various amounts of the tooth surfaces were covered by the stain:

Thin-line, 6, or 15.3 per cent
One-eighth of surface, 4, or 10.2 per cent
One-quarter of surface, 10, or 25.6 per cent
One-third of surface, 7, or 17.97 per cent
One-half of surface, 9, or 23.0 per cent
Two-thirds of surface, 2, or 5.0 per cent
Entire labial surface, 1, or 2.5 per cent

By charting the teeth affected in each mouth, it was possible to draw some rather definite conclusions as to which types are most liable to become repositories for the stain. Figure 8 shows just how many of each kind of teeth (deciduous or permanent, upper or lower, anterior or posterior, right or left) were found to be stained. From a perusal of the chart (Fig. 8), it can be seen that a much larger number of teeth were affected in the upper jaw than in the lower —176 above as compared with forty-four below. It may also be noted that there were 197 anterior teeth with green stain as compared with only twenty-three pos-

terior teeth so discolored. Hence, one seems justified in drawing the conclusion that the teeth of the upper anterior segment are far more liable to have the stain than any other teeth in the mouth.

I realize that my conclusions have been drawn from an investigation of far too few cases, but the data are useful in that they at least point the way to what might and should be undertaken if sufficient time and material were available. There are numerous phases of the problem which have not as yet been answered. In the first place, one must determine just how long the membrane of Nasmyth does exist and then determine whether its presence is a prerequisite for the development of green stain. When that question has been settled, it would be well to make bacteriologic studies from stains in a large number of mouths in order to determine what part bacteria play. One should also attempt to determine just how harmful this particular stain is. An investigation should be made of the relationship which may exist between certain foods and the stain. One must not overlook the fact that the character of the saliva may be partially responsible. Above all, one should see to it that children learn satisfactory technics for maintaining clean mouths and are, by some means, provided with the necessary armamentaria for carrying out these routine procedures.

BIBLIOGRAPHY

1. Chase, S. W.: Origin, Structure and Duration of Nasmyth's Membrane. *Anat. Rec.*, 33:357-375, 1926.

2. Endleman, Julio, and Wagner, A. F.: Pathology, General and Dental (Nasmyth's Membrane). St. Louis: C. V. Mosby Co., 1920, p. 246.

3. Talbot, E. S.: So-Called Nasmyth's Membrane. *D. Cosmos*, 62:162-176, February 1920.

4. Rosse, Werner: Nasmyth's Membrane. Its Development and Clinical and Physical Characteristics. (Abstr.), *D. Cosmos*, 65:1014, September 1923.

5. Burchard, H. H., and Inglis, E.: Dental Pathology and Therapeutics. Philadelphia: Lea and Febiger, 1912, pp. 314-315.

6. Ludington, Paul: Stains and Prophylaxis. *D. Survey*, 10:30-31, May 1934.

7. Marshall, J. S.: Principles and Practice of Operative Dentistry. Ed. 4. Philadelphia: J. B. Lippincott Company, 1914, p. 577.

8. McBride, W. C.: Juvenile Dentistry. Ed. 2. Philadelphia: Lea and Febiger, 1937, pp. 175-176.

9. Best Method of Cleansing Teeth and Removing Green Stain. Disc., *Am. J. D. Sc.*, 4, 2nd ser., 1853-1854, pp. 356-360.

10. Fox, Joseph, and Harris, C. A.: Diseases of Human Teeth, Their Natural History and Structure. Philadelphia: Lindsay and Blakiston, 1855, p. 298.

11. Wedl, Carl: Pathology of Teeth (trans. by W. E. Boardman). Philadelphia: Lindsay and Blakiston, 1872, pp. 359-360.

12. Leber, Theodor, and Rottenstein, J. B.: Dental Caries and Its Causes. Investigation into Influence of Fungi in Destruction of Teeth (trans. by Thomas H. Chandler). Philadelphia: Lindsay and Blakiston, 1873, pp. 29-30, 97.

13. Tomes, John, and Tomes, C. S.: System of Dental Surgery. Ed. 2. London: J. and A. Churchhill, 1873, pp. 560, 728.

14. Taft, J.: Practical Treatise on Operative Dentistry. Ed. 3. Philadelphia: Lindsay and Blakiston, 1877, pp. 25-28.

15. Magitot, E.: Treatise on Dental Caries. Experimental and Therapeutic Investigations (trans. by Thomas H. Chandler). Boston: Houghton, Osgood and Company, 1878, p. 98.

16. Green or Brown Stain on Teeth. *D. Items Int.*, 6:295-296, June 1884.

17. Green Stain upon Teeth (Editorial). *Independent Practitioner*, 9:101, 1888.

18. Miller, W. D.: Chromogenic Bacteria of Human Mouth—Their Relation to Different Colours of Decayed Dentine. *Independent Practitioner*, 9:393-397, 1888.

19. Chupein, T. F.: Removal of Green Stains. *Ohio J. D. Sc.*, 9:385, 1889.

20. Miller, W. D.: Micro-Organisms of Human Mouth. Philadelphia: S. S. White Dental Mfg. Co., 1890, p. 92.

21. Ottolengui, Rodrigues: Methods of Filling Teeth. *D. Cosmos*, 34:707, September 1892.

22. Heide, R., and Charpentier: Contribution to Study of Green Tartar (trans.). *D. Cosmos*, 35:219-220, March 1893.

23. Miller, W. D.: Deposits upon Teeth with Special Reference to Green and Metallic Deposits. *D. Cosmos*, 36:253-273, April 1894.

24. Ottolengui, Rodrigues: Report of Correspondent in Reference to Green Stain of Children's Teeth. *Tr. New York State D.*

Soc., 1894, pp. 33-42, 42-45; *D. Cosmos*, 36: 542-551, July 1894.

25. Seat of Green Stain. *Odontog. J.*, 15: 1894-1895, p. 90.

26. Claude, G. H.: Union Convention of the Washington City Dental Society and the Maryland State Dental Association. Disc., *D. Cosmos*, 37:716, August 1895.

27. Gramm, C. T.: Etiology of Green Stain. *D. Cosmos*, 37:759-764, September 1895.

28. Barrett, W. C.: Classification of So-Called Green Stain. *D. Cosmos*, 37:764-767, September 1895.

29. Palmer, S. B.: Therapeutics of Green Stain. *D. Cosmos*, 37:767-774, September 1895.

30. Green Stain. *D. Digest*, 1:618-628, October 1895.

31. Goadby, K. W.: Mycology of Mouth. New York: Longmans, Green and Co., 1903, p. 24.

32. Colyer, J. F.: Dental Surgery and Pathology. Ed. 3. New York: Longmans, Green and Co., 1910, pp. 681-682.

33. Tomes, C. S.: Manual of Dental Anatomy. Ed. 7. (Nasmyth's Membrane.) Philadelphia: P. Blakiston's Son and Co., 1914, pp. 120-125.

34. Kendall, A. I.: Bacteriology. General, Pathological, Intestinal. Philadelphia: Lea and Febiger, 1916, p. 547.

35. Williams, J. L.: Disputed Points and Unsolved Problems in Normal and Pathological Histology of Enamel. *J. D. Res.*, 5: 27-116, September 1923.

36. Jordan, E. O.: Textbook of General Bacteriology. Philadelphia: W. B. Saunders Company, 1933, p. 216.

37. Badanes, B. B.: Rôle of Fungi in Deposits upon Teeth. *D. Cosmos*, 75:1154-1160, December 1933.

38. Berke, J. D.: Etiology and Histology of Dental Tartars. *D. Cosmos*, 77:134-139, February 1935.

39. Thoma, K. H.: Oral Diagnosis and Treatment Planning. Philadelphia: W. B. Saunders Company, 1936, p. 144.

GENERAL ANESTHESIA FOR MOUTH SURGERY

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NITROUS oxide-oxygen as a general anesthetic for mouth surgery is well established as the safest and most flexible and useful agent of its kind. The necessity for this satisfactory general anesthetic is emphasized by the host of patients whose operative needs or individual makeup demand withdrawal from consciousness not possible by any other means. Opposition to it arises chiefly from three sources: (1) enthusiastic advocates of local anesthesia; (2) those who have not learned to use it and so remain unaware of its blessings; (3) those practitioners who, because of unpleasant experiences, attempt to discredit the use of nitrous oxide-oxygen as unsafe and impracticable. The truth deserves repeating that if any other agent were employed with the same disregard for experience in and knowledge of its employment, the consequences would not be as they are.

Nitrous oxide-oxygen meets the needs of the patient who requires a short general anesthesia without unpleasant or prolonged after-effect, as well as of patients requiring longer narcosis. Its applicability is surprisingly general, but obviously there are limitations, some of which will be recalled by the following "don'ts":

1. Don't attempt the removal of deeply impacted mandibular teeth or similar difficult tasks in unfavorable cases, because you will not succeed and the anesthetic will not be the cause.

2. Don't begin the use of nitrous oxide-oxygen armed only with a few instructions about percentage mixtures and

some vague ideas about the signs of anesthesia.

3. Don't neglect to have the face mask within easy reach, ready for immediate use.

4. Don't have the patient's relatives in the operating room, because you may not be at leisure to explain to them the signs of anesthesia, and without an explanation the appearance of the patient may be somewhat disconcerting to them.

5. Don't depend on the physician who occupies the adjoining suite to administer the anesthetics. The odds are that he knows no more about keeping the patient asleep with the mouth open than you do, and the results may be disappointing and perhaps injurious to your practice.

6. Don't fail to learn something about premedication and to use it when necessary.

7. Don't expect smooth anesthesia if the stomach is full, and don't forget to have the patient empty the bladder. Embarrassment is unnecessary and we should prevent it.

Fig. 1.—Right prop, properly placed, affording adequate vision.

Fig. 2.—Long prop placed between incisor teeth. This procedure is less effective and may cause posterior displacement of the mandible.

EQUIPMENT

For uniformly good results, the armamentarium must contain a modern machine whose operation is thoroughly understood, connected with an adequate supply of both nitrous oxide and oxygen, with attachments which can be depended

Fig. 3.—Long prop placed between incisor teeth, permitting retrusion of mandible to decrease airway.

Fig. 4.—Displacement of mandible by short prop between incisor teeth, causing forward movement with heavy pressure loosening or displacing teeth.

on not to fail. You will also need satisfactory mouth gags for opening the mouth, if necessary with force, gauze packs of various sizes, restraining straps and an effective aspirator to remove blood and saliva.

The assistant, although not necessarily a qualified anesthetist, should know how to operate the machine, be familiar with the appearance and conduct of a patient under general anesthesia and realize what is expected of her.

INDUCTION

The patient is seated well back in the chair the back rest of which is at right angles to the seat, and then the chair is tipped backward so that, with relaxation, the body will slide backward and not forward, out of the chair. The head rest is adjusted so that the airway is straight, and the hands are clasped by interlocking the fingers. After careful study, a mouth-prop is chosen, and this is placed as far back as possible, where it will be most effective, and the patient is cautioned not to push the prop forward with the tongue. Time and effort spent on this seemingly trivial matter of determining the right prop and locating it correctly will be well repaid. Poor working conditions caused by failure to keep the mouth open wide enough complicate the operation needlessly and make breathing difficult by malposition of the mouth-pack. Because of lack of vision, teeth are broken off, soft tissues are lacerated, lips are cut and bruised and the anesthetic level is disturbed. The operator should decide in the beginning how to keep the mouth open, make provision for it and see that it is done. (Figs. 1-5.)

The valve starting the flow of gas is now opened and the nose piece adjusted. If no gas is coming through the tube, there is a sensation of smothering, and since the patient has probably feared this, a bad beginning is made. After a few breaths, the mouth is covered and the mandible is supported, and the patient is assured that all is well. One hundred per cent nitrous oxide is used since the ultimate object is to put the patient to sleep, and long inductions often cause delay and disturbance. When consciousness is partially lost, restraint which will be effective without injury or interference with breathing is applied.

Fig. 5.—Lateral swing of mandible with decreased vision of operative field, which occurs if prop is placed between anterior teeth.

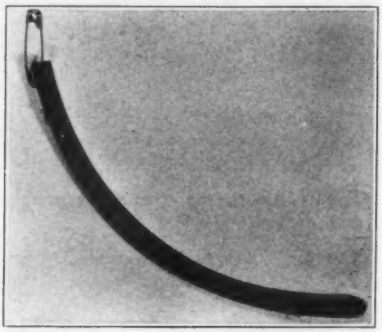

Fig. 6.—Intratracheal (Magill's) tube, made from commercial rubber tubing, 9-12 mm. outside diameter, 25 cm. long, one end beveled at 30 degree angle.

MAINTENANCE

Next, signs of anesthesia are looked for, and when the eyeballs are fixed lat-

erally or downward and breathing is rhythmic, a gauze pack is inserted and tucked well back against the velum with the ends pushed laterally, effectively closing the oropharynx. Judgment must be used as to the size of this first pack because if the space is small, forcing the tongue out of position with a large pack will cause trouble, and, conversely, a small amount of gauze will be useless if the tongue is flat and the tissues are relaxed. In other words, the right pack should be used and blood and mouth fluids should be taken care of with other packs and an aspirator, so that the throat will remain dry.

During the stage of maintenance of anesthesia, the exhaling valve in the nasal inhaler is closed and gases are delivered with enough force to discourage mouth breathing. By adjustment of the bellows pressure, rebreathing is established, and, for any but a short case, is invaluable since it saves both carbon dioxide and nitrous oxide. However, smooth efficient rebreathing and careless mouth packing do not coexist; hence, the latter must not be neglected.

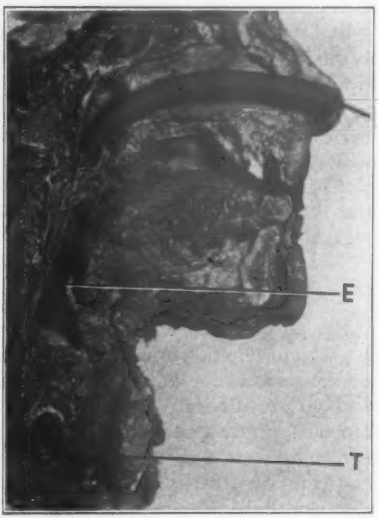

Fig. 7.—Endotracheal tube in position shown extending through naris, oropharynx and nasopharynx past epiglottis (E) into trachea (T).

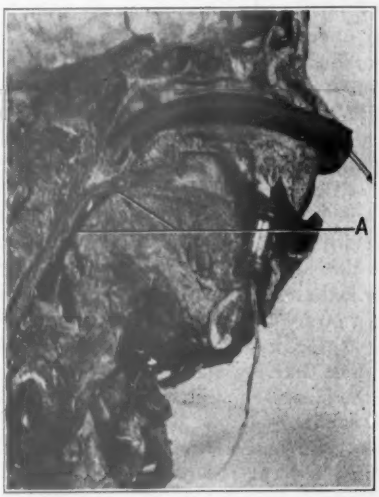

Fig. 8.—Long mouth prop between anterior teeth forcing mandible posteriorly to reduce airway. The presence of the tube prevents obstruction.

RECOVERY

When the operation is completed, the mouth-prop is removed and the mouth slightly closed, the mixture is enriched to 100 per cent oxygen for a few breaths, the nose piece is lifted off and, when the reflexes return, the mouth pack is taken out to avoid gagging, and the restraint loosened. The patient is not allowed to exert unnecessary effort in arising to expectorate. Instead, he should be allowed to use a towel or an emesis dish in the semisupine position. Since, in this twilight of half-consciousness, the patient may be dizzy or terribly frightened, perhaps from a horrible, realistic dream, he should be spoken to softly and assured

that the unpleasant feeling will pass soon; and if there is sobbing, we should explain to him that the cause was just a dream and that all is well again.

If the patient screams, both the mouth and nostrils are closed during exhalation and he is asked *not* to be noisy. Except in young children, unnecessary disturbance is usually avoided in this way. We should be sure too that the teeth can be brought into occlusion, which will rule out the possibility of dislocation at the mandibular joint.

CYANOSIS

Probably the most frequent cause of an uneven, unbalanced maintenance or working stage of surgical anesthesia, not caused by faulty application of the mouth prop or pack, is uncertainty as to when the patient is all right; in other words, failure to accept a degree of cyanosis as normal for some cases and to distinguish it from oxygen want, a rare condition if the airway is clear. As long as the surgeon demands that the thick-necked muscular patient be brought back to a pretty pink when the anesthetic level is satisfactory, as revealed by respiratory, muscle and pupillary findings, poor anesthesia will continue, as will needless explanations to the patient that he is a poor risk and in the future should demand a local anesthetic. Cyanosis is a natural concomitant of anesthesia for many persons, and must be accepted as such. To illustrate this: If an attempt is made to divide a fixed number of units among too many persons, the supply will become exhausted and some will go without any. Likewise, in producing anesthesia with nitrous oxide, there may be insufficient oxygen to combine with all the available hemoglobin and the blood becomes darker, but in no sense is an oxygen deficiency produced when plenty of oxygen is being transported to the tissues. Under the circumstances, there is no cause for worry: such a patient may be anesthetized with perfect safety as long as the signs of anesthesia are observed carefully.

ANOXEMIA

In contrast, the anemic have a lesser amount of hemoglobin, all of which must function abundantly to supply the metabolic needs, but which a much smaller amount of oxygen satisfies, and cyanosis does not appear even if enough oxygen is not available. Waiting in this case for color change to warn of dangerously deep necrosis might be fatal. Thus, the presence or absence of cyanosis cannot be used as a measure of the depth of anesthesia. True, oversaturation with nitrous oxide produces a dark blue or grayish shade, but accompanying this is other evidence which tells the story more vividly than does this color. These principles must be acknowledged and understood before rational management of anesthesia is possible.

ENDOTRACHEAL ANESTHESIA

After surgical anesthesia is produced, the problem remains to maintain it. The most frequent causes of non-performance are nasal obstruction; mechanical interference from misshapen mandibles; struggling, more or less violent, of the patient when the anesthetic level is changed by even a slight dilution with air, and as a result of antral surgery, hemorrhage which pours into the airway unless traumatizing packs are placed in the posterior nares. In such cases, the gases may be transmitted undiluted to their destination by means of so-called endotracheal intubation (Fig. 6), which is accomplished by passing a well-lubricated tube through the more open naris, past the nasopharynx and oropharynx, between the cords and into the trachea. (Fig. 7.)

To accomplish this, surgical anesthesia is first produced and insertion of the tube is attempted by the indirect or blind

method, which frequently is almost immediately successful. Occasionally difficulty is met, and sometimes direct exposure with the laryngoscope is necessary.

Lundy[1] says:

> When there seems to be any respiratory obstruction, dyspnea or heaving abdominal movements, quiet respiration and adequate and easy control of administration of the anesthetic can be brought about by the use of a large bore, soft rubber intratracheal (McGill's) tube.[2] In more than 50 per cent of cases, this tube can be inserted through the nostril and into the trachea without the necessity of opening the patient's mouth or, by use of the laryngoscope, the tube can be placed under direct vision. When the tube is in place, it can be attached to the gas machine and anesthesia can be carried out smoothly, on an even plane, for an *indefinite period.*

These trials consume time, during which the patient wakens. The former level must be restored before continuing. Office practice seldom demands this arrangement, but as a means of sustaining anesthesia under circumstances which offer otherwise insurmountable difficulties, intubation has a particular place. (Fig. 8.)

CONCLUSIONS

If, in deep anesthesia, breathing is not ample, we must investigate to find out why before respiration stops, but if it does, the mouth prop and pack are removed, the mandible is elevated, and the face mask is used to inflate the chest with oxygen. This is timed so that an interval exists for exhalation and the procedure is then repeated. Resuscitation by this means is extremely successful even when circulation as well as respiration apparently has ceased.

The rule "Be sure you are right, then go ahead" is definitely applicable in this work. Confidence appends a carefully evolved plan which one knows will work. Therefore these issues should be determined on each application for general anesthesia: 1. Are there any marked contra-indications such as advanced cardiac disease or respiratory obstruction? 2. Is the mandible short and misshapen so as to predispose the patient to restricted breathing? 3. Is trismus present and, if so, what is the cause? 4. Is there pterygomaxillary or parapharyngeal edema which may indicate localized abscesses ready to rupture if the mouth is opened? 5. Is the operation one which the operator can do well?

If the findings are not satisfactory, another method should be chosen, because, generally speaking, more skill is needed than with local anesthesia to assure the same result; therefore, the surgeon who, through inexpertness and fumbling, requires thirty minutes for ten minutes' work, will not have his task simplified. Clumsy manipulation of the mandible and inattention to the mouth packs change the anesthetic level and needlessly prolong narcosis.

One's judgment of nitrous oxide-oxygen anesthesia must be fair; it is possible that other methods may not have been found infallible. Time spent in learning to administer nitrous oxide-oxygen will be richly repaid in appreciative patients and by increased personal satisfaction at having enlisted another valuable aid in the battle against pain.

BIBLIOGRAPHY

1. Lundy, J. S.: Recent Advances in Anesthesia. *J.A.M.A.*, 110:434, February 5, 1938.

2. Tuohy, E. B.: Intratracheal Anesthesia. *Proc. Staff Meet. Mayo Clinic*, 11:91-95, February 1936.

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NEONATAL DENTAL HYPOPLASIA

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With the increasing interest in child welfare, and particularly in dentistry for children, greater attention has lately been paid to the structural imperfections of the deciduous and permanent teeth. Hypoplastic defects are a permanent record of nutritional disturbances and of diseases that occurred during the formative period of the teeth. It will be the purpose of this report to apply the newer knowledge of tooth formation and calcification and the methods of tooth ring analysis[1, 2] to a better understanding and more detailed evaluation of hypoplastic defects in the human deciduous teeth.

REVIEW OF THE LITERATURE

In 1881, Magitot[3] reported a detailed study of the correlation between the diseases of early infancy and the distribution of enamel hypoplasia ("érosion," as he called it) in the permanent teeth. He reported the findings in forty patients, all of which gave a clinical history of "convulsions and eclamptic attacks" (probably tetany) during the first two years of life. This study was essentially an outgrowth of Legros' and Magitot's fundamental work on the development and calcification of the human dentition, which had appeared eight years before.[4]

In 1893, Zsigmondy[5] reported on "Congenital Defects of Enamel" at the World's Columbian Dental Congress in Chicago. This paper is a classic in several respects. Zsigmondy took exception to the terms "atrophy" and "erosion," which up to that time had been used to designate congenital enamel defects, and introduced the term "hypoplasia." He also stated definitely that enamel hypoplasia occurs in deciduous teeth, although less frequently than in the permanent dentition. From an analysis of the hypoplastic defects, he pointed out that, in the upper jaw, the sequence of calcification of the anterior permanent teeth is: central incisor, cuspid, lateral incisor. This statement was later apparently overlooked, and only recently was it confirmed by the work of Logan and one of us (R. K.).[6] Finally, he gave a very lucid description of the lines of disturbance in the enamel and dentin of hypoplastic teeth. Berten (1895)[7] pointed out that hypoplasia resulted from nutritional disturbances and occurred along the incremental lines in enamel and dentin, which constitute the formative pattern of the tooth.

Only the more recent literature reveals more specific recognition of the occurrence of hypoplasia in the deciduous teeth. Smith and Smith (1935)[8] reported the occurrence of mottled enamel in the deciduous teeth of children living in areas where the water supply contains a high concentration of fluorine (from 12 to 18 parts of fluorine per million). Stein[9] showed that the deciduous teeth of prematurely born children had a comparatively high incidence of enamel hypoplasia and suggested that premature termination of intrauterine existence and

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difficult adjustment to postnatal nutrition might be responsible for such defects. He also emphasized the fact that the distance of the enamel defects from the incisal edge is of significance in deciding at what time of life the hypoplasia developed. But because of the absence of a definite landmark in the tooth, Stein was not able to determine with certainty the chronologic significance of the hypoplasia.

SIGNIFICANCE OF NEONATAL RING IN DECIDUOUS TEETH

The independent discovery of the neonatal ring by Rushton and one of us (I. S.) established such a landmark. Rushton,[10] in 1933, investigated the fine contour lines of the enamel of deciduous teeth and observed one well-marked line at the level of the tooth that is formed at birth. He suggested the term "birthline." One of us (I. S.[11]), by an independent

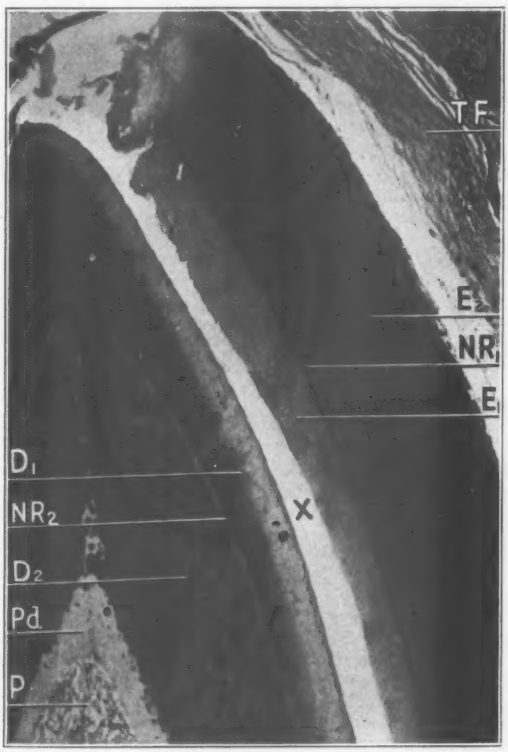

Fig. 1.—Decalcified stained section through upper deciduous central incisor of infant about 4 months old. The neonatal ring is plainly visible in the enamel and the dentin. Its position indicates that this child was born prematurely at about 7 months in utero. This fact may also account for the prominence of the neonatal ring. The dentin is markedly interglobular. The enamel which is normally fully calcified at this age, and therefore lost in decalcified sections, is, in this case, retained in the immature transitional stage. TF, connective tissue of tooth follicle; E_2, postnatal enamel; NR_1, neonatal ring in the enamel; E_1, prenatal enamel; X, artefact (separation between enamel dentin along the dentino-enamel junction); D_1, prenatal dentin; NR_2, neonatal ring in the dentin; D_2, postnatal dentin; Pd, predentin; P, pulp.

and different approach, analyzed the same phenomenon, with further emphasis on the physiologic aspects, and designated it as the "neonatal ring."

As we have stated before[2]:

> Birth is the most profound change in environment and nutrition which man experiences from conception to death. Therefore, it can reasonably be expected that birth and the immediately following neonatal period of adjustment will produce changes in many organs and tissues. But no matter how marked these changes might have been, they soon become indistinct and finally completely obliterated by the continuous process of growth and replacement to which most tissues are subjected.
>
> The teeth, however, are a noteworthy exception to this. Changes effected during growth and calcification of the dentin and enamel remain permanently engraved upon these structures. They can be recognized at any later time, regardless of whether the tooth is still in the mouth or whether it has been shed or extracted. Neonatal injuries are observed in deciduous teeth and occasionally in that portion of the first permanent molar which was growing and calcifying at the time of birth.

In most sections through human deciduous teeth, the time of birth is indicated by a pronounced Retzius line in the enamel and a corresponding contour line of Owen in the dentin. The enamel and dentin located between these neonatal rings and the dentino-enamel junction represent the portion of the tooth which was present at birth; the remainder of the enamel and dentin are of postnatal origin. (Fig. 1.) Moreover, the average rate of deposition of dentin and enamel in the human teeth was determined by one of us (I. S.) in collaboration with H. G. Poncher by means of injections of sodium fluoride,[12] and it was also stated that the prenatal calcification of the dentin was better than the postnatal calcification.

A knowledge of the rate of apposition of enamel and dentin in human teeth (Schour and Massler[13]) permits an accurate check on the data given by Logan and one of us (R. K.)[6] for the formation and calcification of the human dentition. By measuring accurately in a jaw specimen of an infant of known age the

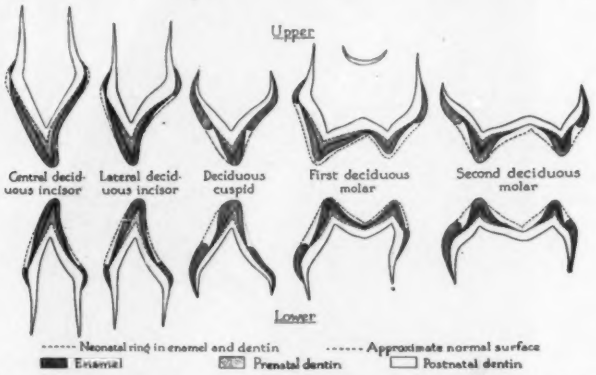

Fig. 2.—Semidiagrammatic tracings of upper and lower deciduous teeth of child with neonatal enamel hypoplasia. Dentin formation has continued in all teeth after birth, whereas enamel formation in most instances terminated at birth. Postnatal enamel was laid down in the cervical portion of the crowns where the ameloblasts were not yet active at the time of birth. Only in the lower deciduous cuspid and in the second deciduous molars has postnatal enamel been formed on top of the prenatal enamel layer. Photomicrographs of some of these teeth are shown in Figures 3 and 4. (Schour and Kronfeld, in Archives of Pathology.)

thickness of enamel and dentin laid down in any given tooth and dividing the figures thus obtained by the average rate of apposition in these teeth, the time of onset of formation and calcification can be determined accurately for each tooth. In the deciduous teeth, the neonatal line in any tooth can be used as a landmark from which the beginning of postnasal formation can be calculated. The results obtained in the deciduous teeth by this technic are given in the accompanying table.

CHRONOLOGY OF HUMAN DECIDUOUS TEETH

	Tooth	Hard Tissue Formation Apposition Begins* in Utero at (Months)	Amount of Enamel Formation at Birth†	Enamel Completed‡ (Months After Birth)	Teeth in Occlusion‡ (Months)	Root Completed (Years)	Shedding# (Years)
Maxillary	Central incisor	4	Five-sixths	1½	7½	1½	7½
	Lateral incisor	4½	Two-thirds	2½	9	2	9
	Cuspid	5	One-third	9	18	3½	11½
	First molar	5	Cusps united	6	14	2½	10½
	Second molar	6	Cusp tips still isolated	11	24	3	10½
Mandibular	Central incisor	4½	Three-fifths	2½	6	1½	7
	Lateral incisor	4½	Three-fifths	3	7	1½	8
	Cuspid	5	One-third	9	16	3¼	11
	First molar	5	Cusps united	5½	12	2¼	9¾
	Second molar	6	Cusp tips still isolated	10	20	3	10½

*First evidence of formation, as seen in histologic sections, is about two months in advance of first evidence of calcification as seen in roentgenograms.

†As indicated by neonatal ring.

‡Preclinical or intraosseous eruption begins at time crown is completed. Girls are, in general, slightly ahead of boys in times of eruption. Most deciduous teeth are in occlusion when clinical eruption has begun. The mean deviation is about 10 per cent from figures given.

#Beginning of resorption is rather variable and is dependent on anatomic relationship of successional teeth. Shedding, therefore, is also rather variable and mean deviation may be as high as six months.

NEONATAL HYPOPLASIA

Since the crowns of the deciduous teeth develop partly before and partly after birth, the neonatal ring plays a particularly important rôle in the analysis of hypoplasia of the deciduous dentition. Stein[9] expressed the opinion that the frequency and severity of the hypoplastic changes in the deciduous dentition are proportionate to the difficulties and disturbances experienced at birth and in the early postnatal period. Therefore, especially pronounced disturbances could reasonably be expected in children with a history of birth injury. It was our good fortune to be able to examine histologically the jaws and teeth of several infants who had suffered birth injuries and whose clinical histories were available.

NEONATAL DENTAL HYPOPLASIA IN A CHILD WITH A BIRTH INJURY

The history of this case is typical. After normal delivery at term, the child, a girl, colored, failed to develop properly or to show a normal response. All the extremities were spastic, with muscles rigid. The infant developed broncho-

pneumonia, to which it succumbed at the age of 7 months and 5 days (218 days). Necropsy revealed a traumatic birth injury. The number of ganglion cells in the brain was reduced, and the glia had proliferated. A general hyperemia of the brain was present.

The jaws were removed at necropsy and fixed in the usual manner. Each jaw was then divided in the midline, and one-half was decalcified in nitric acid, embedded in celloidin, sectioned and stained. Of the other half, ground sections were prepared on Black's grinding machine. (Fig. 4.) Thus, it was possible to compare decalcified sections and ground sections through corresponding teeth of one person, which was very helpful, especially in the study of the enamel.

NEONATAL RING IN THE ENAMEL

Throughout the deciduous dentition, the neonatal ring was very marked both in the enamel and in the dentin. For the study of the enamel, ground sections were used, since most of the enamel had disappeared in the decalcified sections. The prenatal enamel appears uniform and typical in structure and thickness. (Fig. 3.) The neonatal ring is a definite line of disturbance; the course of the enamel rods is markedly changed, and the postnatal enamel shows a dark discoloration. The thickness of prenatal and of postnatal enamel is about the same. This indicates a temporary arrest or a delay in the postnatal development, since the duration of postnatal amelogenesis (seven months and five days) is

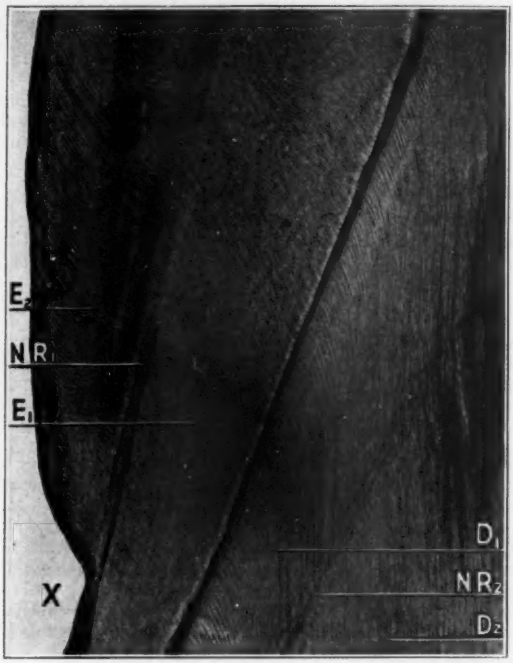

Fig. 3.—Ground section through the lower deciduous cuspid of a child with birth injury and neonatal dental hypoplasia. E_1, prenatal enamel; D_1, prenatal dentin; E_2, postnatal enamel; D_2, postnatal dentin; NR_1, neonatal ring in the enamel; NR_2, neonatal ring in the dentin; X, area of neonatal enamel hypoplasia. (Schour and Kronfeld, in Archives of Pathology.)

certainly longer than the prenatal period of enamel formation in this tooth (about five months). This supposition was confirmed by micrometer measurements and utilization of the knowledge of the rate of formation. A neonatal arrest of approximately sixty days was thus discovered, whereas normally the neonatal arrest is only of from ten to fourteen days' duration.[13]

This disturbance in the deposition of enamel becomes very obvious in other deciduous teeth in this case, in which no postnatal enamel at all had been formed in some parts of the crown. As a typical example, a ground section through a lower first deciduous molar is illustrated in Figure 4. Most of the crown is covered only by the enamel that was present at birth, the neonatal ring, therefore, coinciding with the enamel surface. The cervical one-half of the crown is covered by a thick layer of enamel which begins abruptly at the edge of the prenatal enamel. It surrounds the entire crown like a prominent ledge. This enamel was obviously formed by those cells of the inner enamel epithelium which, at the time of birth, had not yet differentiated into active ameloblasts. This condition, the presence of a thin hypoplastic enamel layer on the tip of the cusps and a circular ledge of enamel in the cervical portion of the crown, is very characteristic of this type of hypoplasia. An illustration by Stein shows this condition. (Fig. 5.) The height of the hypoplastic portion of the crown varies in different teeth. In the incisors, more than four-fifths of the crown may be hypoplastic, with only the gingival one-fifth intact. In deciduous molars, the hypoplasia extends cervically to a lesser extent.

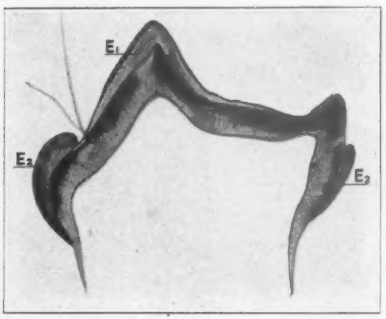

Fig. 4.—Ground section through lower first deciduous molar of child with birth injury and neonatal dental hypoplasia. In the occlusal portion of the crown, enamel formation has terminated at birth. Here, only thin prenatal enamel (E_1) is present. In the cervical portion of the crown, postnatal enamel (E_2) has formed a circular ledge of normal thickness. (Schour and Kronfeld, in Archives of Pathology.)

NEONATAL RING IN THE DENTIN

For every incremental line in the enamel, there exists a corresponding dentin line. Therefore, for every incremental defect in the enamel, there exists a corresponding defect in the dentin. However, although both enamel and dentin respond to mild disturbances in metabolism by a deficient calcification of the incremental layers forming at that time, their reaction to severe systemic disturbances is quite different.

Fig. 5.—Plaster cast of mandibular teeth of child of 4 years born prematurely toward the end of seventh month (birth weight, 3 pounds). Marked hypoplasia of the enamel was present in the occlusal portion of the deciduous teeth. The enamel formation in the occlusal portion of the crown apparently terminated at birth, similarly to the condition shown in Figure 4. Most of the enamel of these teeth, with the exception of this occlusal portion, was formed after birth. (Georg Stein, Ztschr. f. Stomatol., 1936, p. 850.)

Enamel is more sensitive to systemic disturbances than is dentin. In severe systemic disturbances, enamel not only fails to calcify properly, but often, in addition, fails to form at all. The result is a hypoplastic defect in the enamel. The dentin, however, is more resistant and shows only a corresponding interglobular zone (deficient calcification). Lack of or arrest in formation in the dentin is relatively rare, but can be seen as "pulpal inclusions," as in very severe experimental conditions (rickets,[14] parathyroidectomy[15]).

In the case mentioned above, a neonatal dentinal plexus was observed corresponding to the hypoplastic defect in the enamel. (Fig. 6.) This plexus was the result of the neonatal trauma which, in addition to causing the arrest in growth, injured at least one-third of the dentin-forming cells. At the neonatal line, therefore, the remaining two-thirds of the dentin-forming cells formed a fibrillar plexus, such as normally occurs at the dentino-enamel junction, and the dentinal tubules were reduced in number. In addition, the neonatal predentin did not calcify and remained as a neonatal band of uncalcified dentin.

The neonatal effect in the dentin is rarely so severe as in this case and is more often evidenced as a zone of neonatal interglobular dentin.

DECIDUOUS TEETH OF A CHILD OF PREMATURE BIRTH WITH BIRTH INJURY

Through the cooperation of Robert G. Heupel, of the Children's Memorial Hospital, it was possible to study the dental conditions in a girl, aged 7 years, who had a clinical history of premature birth and apparent birth injury, which resulted in delayed physical development and in unilateral partial paresis. The plaster casts of the jaws show hypoplastic defects in the incisal and occlusal portion of the deciduous teeth, especially of the deciduous incisors and cuspids. (Fig. 7.) The incisal edge of the incisors and the tip of the cuspids are covered with a very thin layer of enamel, which terminates abruptly where it joins the normal thick enamel of the remainder of the crown. The first permanent molars are intact. Several of the deciduous teeth were obtained when they were shed, and ground sections were prepared, which show very plainly the neonatal character of the hypoplasia. (Figs. 8 and 9.) The

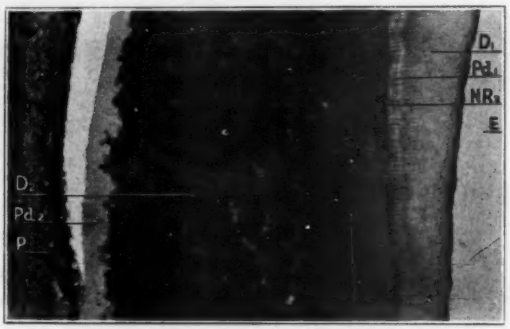

Fig. 6.—Decalcified stained section through dentin of upper first deciduous molar of child with birth injury and neonatal dental hypoplasia. E, enamel space; D_1, prenatal dentin; Pd_1, prenatal predentin; NR_2, neonatal ring and plexus in dentin; D_2, postnatal dentin; Pd_2, postnatal predentin; P, pulp. The prenatal dentin is well and uniformly calcified, whereas the postnatal dentin is poorly calcified and shows many interglobular spaces.

tip of the crown is covered by thin prenatal enamel. On top of it and separated from it by a very pronounced neonatal ring is a thick layer of postnatal enamel which ends short of the incisal edge, a clinical appearance of enamel hypoplasia resulting.

In this case, as in the other one described in Figures 2, 3 and 4, the enamel hypoplasia of the deciduous teeth is decidedly neonatal and postnatal in character. Up to birth, the enamel was normally formed. The neonatal ring forms a sharp dividing line between normal prenatal and hypoplastic postnatal tissue.

ACCENTUATED NEONATAL RING IN A CHILD WITH BIRTH INJURY

Figure 10 shows a ground section of a second deciduous molar of a child with a history of birth injury. The effect is not so pronounced as in the two previously described cases. It is visible merely as an accentuated neonatal ring in the enamel and possibly in a poorer calcification of the postnatal enamel.

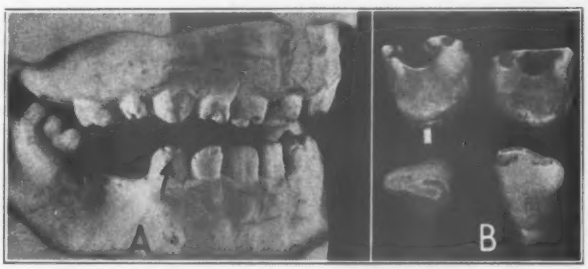

Fig. 7.—A: Plaster cast of deciduous teeth of child of 7 years born prematurely and with a birth injury. In the incisal portions of all deciduous teeth, enamel formation came to a standstill at birth, enamel hypoplasia of the incisal part of all of these teeth resulting (arrow). The first permanent molars are intact, which is characteristic of true neonatal hypoplasia. B: Deciduous upper central incisors and one lower central incisor. The incisal edges are covered with a very thin layer of prenatal enamel, the remainder of the crown by postnatal enamel of normal thickness. (Patient seen through cooperation of Robert G. Heupel.)

CALCIFICATION OF THE PRENATAL ENAMEL AND DENTIN

Throughout the approximately fifty complete jaws of infants and young children and the shed or extracted deciduous teeth of more than 600 additional children so far examined histologically by us, the portion of enamel and dentin prenatally formed showed uniformly good calcification. The prenatal dentin is invariably of homogeneous appearance without interglobular spaces. Interglobular dentin is found only in the postnatal portion of the deciduous teeth.

These observations are in agreement with the general trend in the literature, which contains only a few exceptional cases of disturbances in prenatal calcification. Wolfe[16] describes two cases of "fetal rickets" in Chinese. The mothers had suffered from gross nutritional deficiencies, as evidenced by the clinical observation of tetany, osteomalacia and very low blood calcium values. Toverud[17, 18] reports imperfect calcification of prenatal enamel and dentin in stillborn infants of women whose diet was deficient in minerals and vitamins.

Mellanby[19] reports hypoplastic defects in young pups whose mothers had been fed deficient diets. However, it is questionable whether she could distinguish prenatal from postnatal tissue in the absence of a definite landmark (neonatal ring or vital injection), and it is just as

likely that the hypoplastic defect she ascribes to the prenatal period may have occurred during the early infancy period. Moreover, Figure 11, which is a reproduction of Figure 3, subfigure 4, of Mellanby's report in the *British Dental Journal,* is a photomicrograph of an area of "gross" hypoplasia in a human second deciduous molar which, in the light of our present knowledge, is readily interpreted as a neonatal hypoplasia. This illustration is very similar to our Figures 4 and 9, for which a history of neonatal injury was definitely established. In

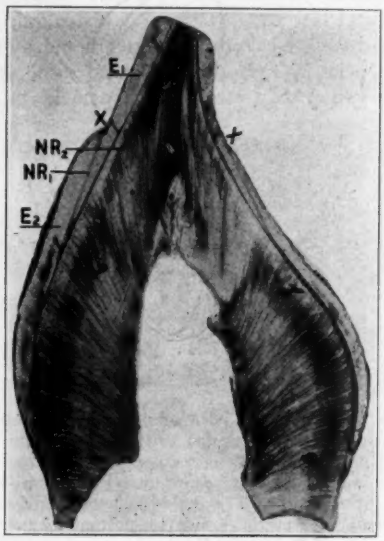

Fig. 8.—Labiolingual ground section through upper deciduous lateral incisor shown in Figure 7. Neonatal enamel hypoplasia is evident on both the labial and the lingual surface. The position of the neonatal ring is relatively high because of the premature birth. There is a sudden change in the thickness of the enamel at X. E_1, prenatal enamel; NR_1, neonatal ring in the enamel; E_2, postnatal enamel; NR_2, neonatal ring in dentin.

either case, in referring to human teeth, Mellanby states that the prenatal tissues have the best chance of calcification.

Hess[20] and his collaborators are definitely of the opinion that the total amount of mineral salts present in the teeth of the newborn is too small to be markedly influenced by the maternal diet. They state:

> The conclusion would seem inevitable that, as far as the teeth of the infant are concerned, it cannot be of great importance whether or not, throughout pregnancy, a mother consumes a diet high in calcium and phosphorus. She is provided with a bounteous storehouse of these substances in the bony skeleton from which she can, with the greatest facility and without suffering the slightest harm, withdraw this 0.5 gm. required for the denture of the fetus.

Stein[9] is of the same opinion. He says:

> It has become customary to pay special attention to the diet of pregnant women from the viewpoint of good dental development. According to the prevailing opinions the nutrition of the pregnant woman is very important for good development of the child and for prevention of disposition to disease. The importance of this factor for the development of the dental hard tissues, however, seems to be greatly overestimated, at least in our country, with the possible exception of grave diseases of the mother; because, as already shown, major formative defects in the prenatally formed portion of the teeth are extremely rare.

Our own findings tend to support the opinions expressed by Hess[20] and by Stein.[9] On the basis of histologic examinations, using the neonatal ring as a biologic landmark, demarcating the prenatal from the postnatal tissues, we have come to the following conclusions: *In utero* calcification normally takes place homogeneously and completely. It is not markedly influenced by fluctuations in the condition of the mother, except perhaps in cases of grave maternal illness or a deficiency, such as osteomalacia. However, after birth, the calcification of the teeth is very much influenced by the state of the infant's health. Beginning with birth and the neonatal period, which leave their mark in every deciduous tooth, there are usually zones of dis-

turbed calcification in the teeth, particularly from birth to 10 months of age, which express the vicissitudes of the first few years of life.

It has been said that the quality of prenatal calcification may influence the caries incidence in deciduous teeth. This claim is based upon a disregard of the anatomic facts. *Caries always begins at the surface of the enamel, which, with the exception of the incisal portion of the incisors, consists of postnatally formed enamel.* The highest incidence of caries in deciduous teeth lies in the proximogingival level of all teeth and in the occlusal fissures of the deciduous molars. Thus, it can be seen, by simple observation, that caries in deciduous teeth always begins in postnatal enamel, and its incidence cannot be affected by any prenatal quality or modification of calcification.

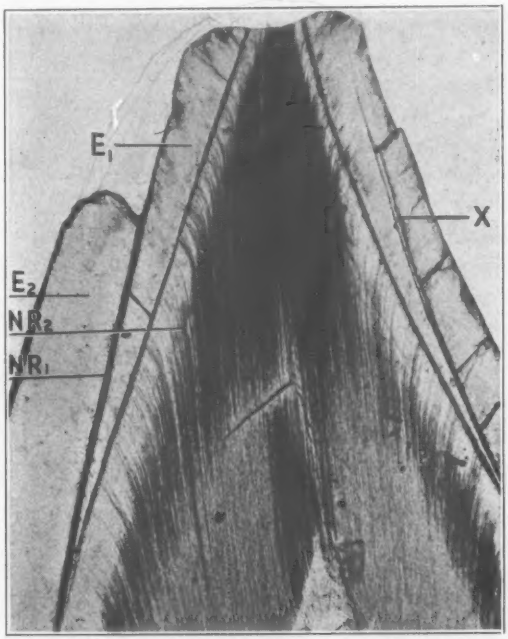

Fig. 9.—Labiolingual ground section through upper deciduous central incisor shown in Figure 7. (Lettering same as in Figure 8.) There is an artificial separation of prenatal and postnatal enamel along the neonatal ring on the lingual side of the crown, X.

COMMENT

It may be well at this time to define more exactly the term "hypoplasia," which was first emphasized in reference to enamel by Zsigmondy.[5] By definition, hypoplasia means a deficient or arrested formation. Zsigmondy recognized that the essential characteristic of enamel hypoplasia is an interruption, however slight, of enamel formation, which finds its expression in an uneven, irregular surface. In its mildest form, the enamel may be merely pitted; in its severest form, the enamel may be almost completely absent. Therefore, the term should properly be restricted to defects in formation and not to defects in cal-

cification. For the latter, the term "hypocalcification" is available. In the development of both enamel and dentin, we have to distinguish clearly between the apposition of an organic matrix and its subsequent calcification. In case of enamel hypoplasia, apposition is disturbed and macroscopic defects in the form and outline result. On the other hand, when the apposition of the ground substance takes place normally, but the calcification of the enamel is interfered with, the result will be a tooth that appears normal in contour, but is poorly calcified.

A classification of the different types of disturbances in the calcification of both enamel and dentin has been given.[21]

Disturbances in calcification are much more common than disturbances in formation. There is experimental and clinical evidence that the process of calcification is more sensitive to systemic disturbances than is formation. Therefore, the same systemic interference may cause either a hypocalcification or hypoplasia, depending on the degree of disturbance. A mild disturbance may cause deficient calcification without affecting the formation of the organic matrix, but a severe disturbance may cause a hypoplastic defect in addition to deficient calcification. Thus, hypocalcified and hypoplastic defects, although arising from two different developmental processes, are yet related inasmuch as they indicate

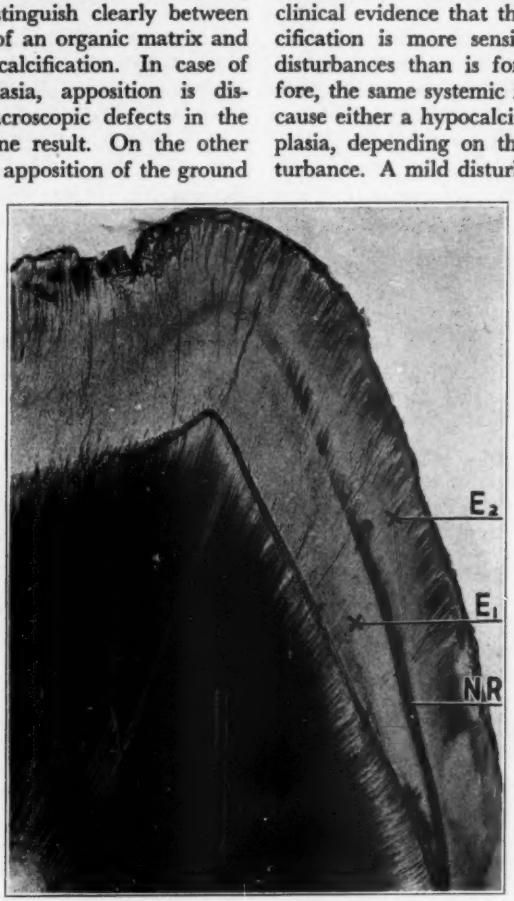

Fig. 10.—Accentuated neonatal ring (NR_1) in enamel of lower second deciduous molar of child with traumatic birth injury. The difference in calcification between the prenatal (E_1) and the postnatal (E_2) enamel is evident.

different degrees or intensities of systemic or local disturbances.

It is suggested, therefore, that the term "dental hypoplasia" be confined to those defects in the dental tissues which are the result of a deficient deposition of the extracellular products of the formative cells and which clinically manifest themselves as irregularities or indentations of the enamel surface. Such hypoplastic defects may be of local or of systemic origin, the latter being by far the more common.

Localized enamel hypoplasia is usually confined to the bicuspids, and may be the result of an infection and inflammation of the apical region of the deciduous

Fig. 11.—Photograph of ground section through human deciduous molar (published by Mellanby). The hypoplasia is obviously neonatal in character. There is a close resemblance to the authors' Figures 4 and 9 and a marked difference in the calcification of prenatal and of postnatal dentin.

molar which destroys the ameloblasts of the permanent tooth germ. The development of this kind of hypoplasia in human teeth has been studied by Bauer[22] and recently by Morningstar.[23] The affected teeth, known as Turner teeth, show poorly developed, defective enamel areas. Sometimes, almost all of the enamel is missing. Usually, only one or two teeth are so involved, the other bicuspids in the same mouth being normal.

Systemic hypoplasia, on the other hand, strictly follows a developmental pattern, since the etiologic agent is of a systemic nature and affects all the formative cells that are active at that time. Chronologically, it affects corresponding areas on different teeth or tooth groups.

A noteworthy difference exists between the involvement of ectodermal (enamel) and mesodermal (dentin) dental tissues in hypoplasia. The ectodermal formative cells—the ameloblasts and other structures of the enamel organ—are more vulnerable and less amenable to repair and regeneration than the mesodermal pulp tissue. This is clearly seen in Figures 2 and 4, which show amelogenesis completely arrested by the birth injury, whereas dentin formation, after a transitional period of retarded and disturbed growth, continued normally up to the time of death or of shedding. A further illustration of this difference in tissue reactivity is shown in Figure 12, in which there is a very marked difference between prenatal and postnatal enamel, whereas the corresponding difference in the dentin cannot be so readily discerned.

A similar result is observed in mild fluorosis and other mild interferences in which mottling of the enamel is seen, but no changes are visible in the dentin (Black and McKay[24]). Again, in severe fluorosis and other grave interferences, the enamel is frequently hypoplastic, whereas the dentin shows only interglobular zones (hypocalcification). In only extremely severe disturbances (parathyroidectomy,[13] rickets,[14] hypovitaminosis A[25]) can vascular inclusions be observed in the dentin (dentin hypoplasia).

Therefore, enamel formation is much more subject to disturbances than is dentin formation, because of the greater sensitivity and lower threshold of reactivity of the ameloblasts. Enamel hypoplasia is therefore much more common than hy-

poplasia of the other dental tissues and is the condition usually observed by the clinician.

When studying dental hypoplasia both clinically and histologically, one is impressed with the individual differences in extent and distribution of the defects. Clinically, for instance, one may find hypoplastic enamel on the labial side and apparently normal enamel on the lingual side of the same tooth, or pitting instead of continuous rings on a given surface. For this phenomenon, we have no explanation beyond the general truism that among all cells of the body, there must be individually different resistance to injuries of any kind. Thus, under the influence of the same noxious agent, some ameloblasts may cease to function, others may be temporarily disturbed and later recover, and again others may not be perceptibly affected.

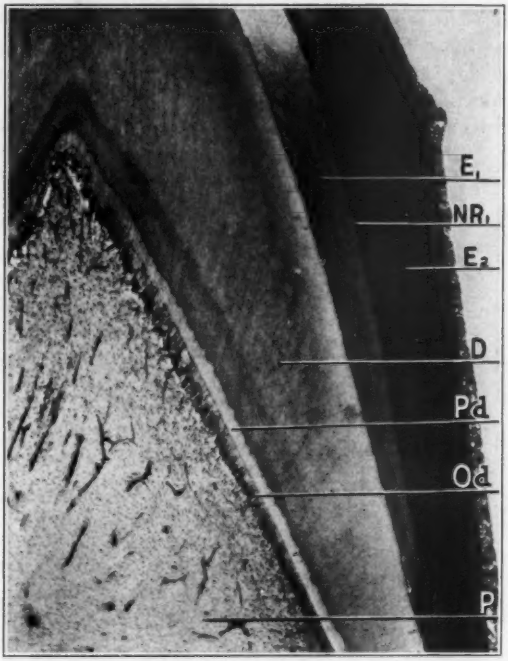

Fig. 12.—Decalcified stained section through lower deciduous cuspid of infant 1 month old. The neonatal ring is very pronounced in the enamel, but not discernible in the dentin. E_2, postnatal enamel; NR_1, neonatal ring in enamel; E_1, prenatal enamel; D, dentin; Pd, predentin; Od, odontoblasts; P, pulp.

SUMMARY

1. "Neonatal dental hypoplasia" designates a disturbance in the formation rather than the calcification of enamel and dentin that originates during the neonatal period.

2. The deciduous teeth are affected by neonatal dental hypoplasia. The permanent teeth, because of their postnatal formation, are not involved, with the possible exception of the mesiobuccal cusp of the first permanent molars.

3. In its mildest form, a neonatal dis-

turbance is reflected as an accentuated neonatal ring in the deciduous teeth.

4. In the severe type of neonatal disturbance, the enamel formation is arrested at birth or during the neonatal period (neonatal enamel hypoplasia). Postnatal amelogenesis is confined to the portion of the crown which is located cervically from the enamel area present at birth. The result is a tooth with a very thin layer of prenatal enamel at the incisal edge or occlusal surface and a circular ledge of normal postnatal enamel.

5. The dentin is much less reactive than is enamel. Dentin formation is arrested for only a relatively short period of time and recovery usually occurs. The result is sometimes seen as a neonatal dentinal plexus.

6. Prenatal calcification is uniformly much more homogeneous than is postnatal calcification. Prenatal hypoplasia is extremely rare. Our observations support the contention that the fetus is well protected *in utero* and are in accord with statements of Hess and his associates to the effect that the prenatal mineral metabolism of the mother is, as compared to the child's postnatal nutrition, of little significance to the child's teeth.

BIBLIOGRAPHY

1. Schour, Isaac: Growth Pattern, Growth Rhythm, and Ring Analysis of Tooth. *Anat. Rec.*, 67:45, March 1937.

2. Schour, Isaac, and Kronfeld, Rudolf: Studies in Tooth Ring Analysis. IV Neonatal Dental Hypoplasia. Analysis of Teeth of Infant with Brain Injury at Birth. *Arch. Path.*, 26:471, August 1938.

3. Magitot, E.: Études Cliniques sur l'Érosion des Dents Considerée Comme Signe Rétrospectif de l'Éclampsie Infantile (Clinical Studies of Dental Erosion Considered as a Retrospective Sign of Infantile Eclampsia). *Gaz. des Hôp.*, 54:891, 1881.

4. Legros, Charles, and Magitot, Emile: Origine et Formation du Follicule Dentaire Chez les Mammifères (Origin and Formation of Dental Follicle in Mammals). *J. de l'Anat. et de la Physiol.*, 5:449, 1873.

5. Zsigmondy, Otto: Beiträge zur Kenntnis der Entstehungsursache der Hypoplastischen Emaildefecte (Congenital Defects of Enamel), *Tr. World's Columbian D. Cong.*, 1:48, 1894.

6. Logan, W. H. G., and Kronfeld, Rudolf: Development of Human Jaws and Surrounding Structures from Birth to Age of Fifteen Years. J.A.D.A., 20:379, March 1933.

7. Berten, J.: Hypoplasie des Schmelzes (Enamel Hypoplasia). *Deutsche Monatschr. f. Zahnheilk.*, 13:425, 483, 533, 587, 1895.

8. Smith, Margaret C., and Smith, H. V.: Occurrence of Mottled Enamel on Temporary Teeth. J.A.D.A., 22:814, May 1935.

9. Stein, G.: Schmelzschäden am Milchgebiss und ihre Klinische Bedeutung (Enamel Defects in Deciduous Dentition and Their Clinical Significance). *Ztschr. f. Stomatol.*, 34:843, No. 14-15, 1936.

10. Rushton, M. A.: Fine Contour-Lines of Enamel of Milk Teeth. *D. Rec.*, 53:170, April 1933.

11. Schour, Isaac: Neonatal Line in Enamel and Dentin of Human Deciduous Teeth and First Permanent Molar. J.A.D.A., 23:1946, October 1936.

12. Schour, Isaac, and Poncher, H. G.: Rate of Apposition of Enamel and Dentin, Measured by Effect of Acute Fluorosis. *Am. J. Dis. Child.*, 54:757, October 1937.

13. Schour, Isaac and Massler, M.: Rate and Gradient of Growth in Human Deciduous Teeth, with Special Reference to Neonatal Ring. *J. D. Res.*, 16:349, August 1937.

14. Becks, Hermann, and Ryder, W. B.: Experimental Rickets and Calcification of Dentin. *Arch. Path.*, 12:358, September 1931.

15. Schour, Isaac; Chandler, S. B., and Tweedy, W. R.: Changes in Teeth Following Parathyroidectomy (I). *Am. J. Path.*, 13:945, November 1937.

16. Wolfe, John J.: Teeth in Fetal Rickets. *Am. J. Dis. Child.*, 49:905, April 1935.

17. Toverud, Guttorm: Importance of Nutritional Condition in Development of Teeth and Jaws. *D. Mag.*, 49:1199, November 1932.

18. Toverud, Guttorm: Die Pränatale Fürsorge des Gebisses (Prenatal Care of Teeth). *Deutsche Jugendzahnpflege*, 25:45, 1937.

19. Mellanby, May: Rôle of Nutrition as Factor in Resistance to Dental Caries. *Brit. D. J.*, 62:241, March 1, 1937.

20. Hess, A. F.; Lewis, J. M., and Roman, B.: Radiographic Study of Calcification of Teeth from Birth to Adolescence. *D. Cosmos*, 74:1053, November 1932.

21. Schour, Isaac, in Gordon's Dental Science and Dental Art; Chapter I. Lea and Febiger, Philadelphia, 1938.

22. Bauer, W.: Ueber die Entstehung der sogenannten "Turnerzähne" (Origin of So-Called Turner Teeth). *Ztschr. f. Stomatol.*, 33:1089, September 27, 1935.

23. Morningstar, C. H.: Effect of Infection of Deciduous Molar on Permanent Tooth Germ. J.A.D.A., 24:786, May 1937.

24. Black, G. V., and McKay, F. S.: Mottled Teeth: Endemic Developmental Imperfection of Teeth Heretofore Unknown in Literature of Dentistry. *D. Cosmos*, 58:129, February; 477, May; 627, June; 781, July; 894, August 1916.

25. Schour, Isaac, and Smith, Margaret C.: Changes in Incisors of Albino Rats in Vitamin A Deficiency, to be published.

A STUDY OF THE TOOTHBRUSH (IV)

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I

TOOTHBRUSHES depend for their cleansing function on the bristles, which constitute the chief working elements of these hygienic devices. As commonly used in nearly all toothbrushes, bristles are the long hair growing on the back and neck of the hog. They may be white, particolored or black, according to the region in which the animals are raised. A hog (family *suidae)* is a swine, which may be pig (male), sow (female) or boar (male). The boar is a wild hog in contradistinction to the domesticated types of swine as represented by the pig and sow.

II

Bristles are produced in all countries in which hogs are grown. The best bristles come from countries where the climate is cold, particularly Northern Asia. Until comparatively recently, Russia and the United States were the foremost producers. Before the development of brush-making industries in the United States, this country exported large quantities of bristle, but, for many years, the increased demand for bristles in our land has caused us to become one of the largest bristle importers. Belgium, China, France, French Indo-China, Germany, India and Poland also produce bristles, but as exporters of native stock, the Chinese hold first rank in the bristle industry. Hogs are raised everywhere in China and bristles are produced throughout the country. Generally speaking, in South and Central China, particolored pigs are raised, and in North China, black pigs predominate. There the animals are lean and sparsely covered with long, coarse hair, which furnishes the best bristles. The city of Tientsin is the largest collecting and exporting center in the country; Chunking ranks second, Hankow third, Newchwang (Manchuria) fourth and Shanghai fifth. Tsingtao, Kowloon and Canton are other important export centers. China's bristle trade is liveliest from October to March, little business being transacted between March and October as the warm weather renders the bristles too soft for handling and necessary treatment.

Although the American hog is a large factor in our meat supply, its bristles are inferior for use in brushes, being too short, soft and curly and poor in color and texture. Since the Yankee hog is raised exclusively for its pork, it is killed before the bristles have time to develop properly and therefore the latter are used merely incidentally in cheap paint brushes and as curled hair for mattresses and automobile cushions. For superior bris-

tles, we must go to Europe and Asia, where the animals are of wilder and sturdier type. The craving of the Russian people for good pork from hogs 3 to 4 years old is an exciting factor in the production of the world's best bristles. The cold regions of Russia and Siberia are conducive to the growth of long, stiff and elastic bristles which wear slowly when used. The Russian bristles are white, black and particolored, as are the American and Chinese. "Lilies" are of the whitest and finest texture. The bristles are collected after being shed or after the slaughter of the hog for meat supply. The greatest quantity comes from China, where the people, being fond of pork, as are the Russians, raise hogs in large numbers. These bristles are given various trade names, such as "Tientsin," "Hankow," "Cork Chop" and "Superior Hankow." The Chinese are not communicative and their methods of bristle preparation are unknown outside their bristle regions.

India also collects bristles for domestic brush use. Others are exported mostly to the United Kingdom. Because of the warm climate, their bristles are of a poorer grade than those from the more Northern countries. The center of trade is in the United Provinces in Northern India, where buyers travel from one small town to another, buying bristles, usually in poor condition, and taking them to larger towns for preparation at the factory.

III

The hog bristle originally has a "butt" end, the part nearest the hair follicle, and the stiffest and choicest portion. The body of the bristle, which is narrower in diameter, is used in the toothbrush; the outer end is the split extremity, or "flag." The latter protects the hog by assisting collectively to form a mat of the adjacent split ends, thereby serving to shed ice and snow and keep out cold. In the Chinese bristle, the "flag" is shorter and coarser, since the protection from cold is not so urgent. The Russian bristle also has a distinct "barb" (like a fishhook), which encircles it, with the hook directed toward the "flag." It grows on the bristle to prevent ice, snow and water from working down toward the hide. This "barb" is negligible in the Chinese product. The "flag" end is used only in paint brushes to smooth out the paint.

After the hog is killed, it is ducked in boiling water and then the hair is clipped off by means of scissors. The best hair comes from the back of the neck, the rest of the body being covered with short soft hair. The total hair obtained from one animal does not exceed five catties at the most (a catty being equivalent to one and one-third pounds), whereas the yield of long straight hair comes to about half a catty per head. When bristles arrive at a factory, they are immersed in large jars filled with water and left for ten days in summer and fifteen days in winter. They are then rinsed in clean water and dried well by the sun or by charcoal fire, being laid separately on small pieces of board and bound flat on each board. The bristles thus tied to boards are now placed on a sieve and steamed for many hours. They are put through this process to prevent curling. After the steaming is completed, the bristles are released from the boards to which they were bound, and after being sorted and arranged according to color and length, are tied up in bundles each of which measures about 2 inches in diameter at the end. This method was first practiced by Tientsin bristle merchants in Chungking, Szechuan, and consequently the finished article produced through the process is known even now as the Chungking bristle.

The Chinese also use another method to straighten bristles. As bristle is very absorbent, this property is used to advantage by tightly packing in perforated galvanized iron cones open at both ends. The cones are then placed in water con-

taining a soap solution to remove the dirt. The cones and their contents are boiled for several hours. The bristles, absorbing water freely, swell and, under the pressure exerted over their entire length, the cones, being of the same relative taper, are made perfectly straight from end to end. They are then dried in a vacuum dryer.

One can easily distinguish bristles arranged under the steaming system from those which are not, because the former are tied with yellow strings, whereas the latter are tied with pink strings.

On arrival of the raw cargo in the packing house, the bristles are first sorted according to softness and stiffness and according to quality. The respective portions are then sorted into separate lengths, after proper scouring. After the clean bristles are separated into bundles of uniform lengths, varying from 2 to 6 inches, the separator is ready to combine bristles from different sources of supply in order to secure the desired color, elasticity and stiffness. In addition to this, the quality depends on the solidity of the bundle. It is very seldom that all the bristles of a given length are the same length, the usual practice being to give 30 to 50 per cent of "top"; that is, to include all bristles exactly the same length as the indicated length of bundles and the varying amounts of bristles in the same bundles, one-eighth to one-fourth inch and three-eighths inch down to perhaps one inch shorter than the longest lengths in that bundle. By properly mixing these various lengths in the bundle and tapping with flat wooden paddles, the "butt" or flesh ends may be brought fairly close together, the result being a bundle of uniform appearance. Before these bundles are wrapped in paper, they are usually laid out and sprinkled with a 40 per cent formalin solution, to disinfect the bristles. After treatment in this way, a certificate of disinfection can be obtained for shipment to such countries as the United States or Australia. Otherwise, shipments intended for such countries have to be officially disinfected by steam.

The bundles are then wrapped in small paper, two bundles together, and packed in wooden cases lined with Chinese oiled paper with a good sprinkling of camphor or napthaline. The contents of the cases are arranged to bring the net weight to 1 pecul (133⅓ pounds). The cover of the case is left unnailed so that the contents can be examined at any time.

IV

The quality of the bristles depends more on the regions where they are produced than the manner in which they are prepared. Points of importance in determining bristle quality are color, straightness, stiffness, diameter, length and method of treatment. Hogs raised in the mountainous regions of Northern China have stiff, coarse hair, whereas animals that are kept mostly at home and fed with refuse produce poorer bristles. Great skill is particularly necessary in the judging of percentage of humidity, amount of dead hair, length, elasticity, etc., and in seeing that they are not spotted. Some Chinese dealers have mixed in horse hair, not so stiff as hog bristle, but cut to similar length and dyed the same color. Sometimes cowhair is also used. These substitutes are far less expensive than hog bristle.

The method used by Chinese bristle experts in examining bristle is to select bristles and pull them. The real bristle will not break easily. Again, the tail hair is cut at both ends, that of the bristle only at one end, the other being split into five pieces. There are several other points, too technical to describe here, which are observed in inspecting bristles.

V

Some Chinese dealers sell bristles made up, assorted and packed ready for shipment to exporters, leaving only the in-

spection of the bundles to be carried out. Where business has been developed, however, the export firms handle the raw material, sort, clean and dress it, and pack it according to their own specifications, which gives them complete supervision over every aspect of the trade. Most of the exporting firms have their own factories, in which they employ large staffs of native dressers. Generally speaking, most Chinese bristle is bought and sold during the winter months, little business being transacted during the summer. The bulk of the shipments go to the United States, England and Japan, although France also gets some. Japan is making great strides in the brush industry, but in quality the Japanese brushes are inferior to those made in England, France and the United States. Originally, Russia was known as the world's largest bristle producer, but since the Great War, Russia's bristle trade has markedly decreased. The world's demand is yearly increasing; however, production is greatly decreasing in all countries except China. Bristle merchants of late years have given their greatest attention to China because the prospect of a good output is not only assured, but also the quality of Chinese bristle has so improved as to almost equal that of the Russian product, with the result that China ships about six million catties of bristles each year to foreign countries. Of course, these exports are used not alone for toothbrushes, but also in the manufacture of all kinds of brushes, as thread for sewing shoes and harness and on machinery such as spinning and tobacco machines. Since the bristle output is not large enough to meet the demand, efforts are constantly being made to find a substitute, but up to the present time no satisfactory results have been obtained.

It is not possible to state the amount of bristle used in this country for toothbrush manufacture since no records are available for that purpose. Government statistics apply to bristles imported for all kinds of brushes collectively, and no analysis is made of these gross figures. Bristles sorted, bunched or prepared are dutiable at the rate of 3 cents per pound under paragraph 1507 of the Tariff Act of 1930. Under that classification, there was in 1936 a total import into this country from all other countries of 6,166,289 pounds, the value of which was $9,054,983. Bristles not sorted, bunched or prepared amounted, for that year, to only 78 pounds, the import value of which was $175. Five-sixths of the entire bristle import came from China.

Many of the facts collected for this paper, as for the three previous studies, were obtained through the courtesy and cooperation of the officials of the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce, Washington, D. C.

BIBLIOGRAPHY

American Brush Manufacturers Association, Philadelphia, Pa. Personal communication to author, January 10, 1938.

Bureau of Customs, Treasury Department, Washington, D. C. Communication to author, August 26, 1938.

U. S. Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Communication to author, March 22, 1935.

Idem: Communication to author, August 9, 1938.

KAUFFMANN, J. H.: Study of Toothbrush (I). *D. Cosmos*, 66:300, March 1924.

Idem: Study of Toothbrush (II). *D. Cosmos*, 71:132, February 1929.

Idem: Study of Toothbrush (III). *D. Cosmos*, 74:601, June 1932.

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IS THERE A PLACE FOR THE DENTAL HYGIENIST IN THE DENTAL OFFICE?

By HARRY G. MORTON, D.D.S., Milwaukee, Wis.

THERE is an old saying to the effect that a majority of the people have no definite plan of life; but every successful man or woman in business, the professions, politics must have had a definite plan of life, and in our profession it is absolutely true that with a plan of life, with constructive imagination, with preparedness, one is ready to meet obstacles and emerge above the plane of those who have not this plan of life.

The man in business, manufacturer or merchant, builds an institution which must employ not alone mechanical appliances and means, but also a personnel of specialized individuals trained to carry out successfully his business enterprise.

In medicine, we have the same examples of men and women who have a definite plan of life, who have constructive imagination, who have taken their degrees as a starting point and have surrounded themselves with individuals who are prepared specifically to handle the various phases of medicine: the pathologist, the chemist, the physiologic chemist. Medical institutions have highly developed departments devoted to the study of all conditions of the body, and these departments are specifically for the use of the medical man who is employing all of the knowledge available in the art of healing.

The dentist of forty years ago did everything himself. It was my privilege at that time to be an associate in an office where constructive imagination led to the establishment of the first incorporated public dental laboratory, the growth of which from that time on is an example of what highly specialized men can do in taking over a department of dentistry to assist the practicing dentist and enable him to do more and better work.

My subject is "Is There a Place for the Dental Hygienist in the Dental Office?" I should like to answer the question by asking another: What is the status of the practicing dentist today?

We have in this country today under organized dentistry approximately 42,515 men and women, grossly about one-half the licensed operators. In the State of Illinois, there are approximately 3,720 members of organized dentistry, with a possible 6,500 licensed. It is further estimated that, as recently published, the average income of the American dentist is comparatively high, the gross income being approximately $4,170 a year for the period 1922-1936, standing third, with that of the medical profession and of the profession of law first and second, respectively. In my opinion, the dental profession use less of their opportunities than any other profession, and were their many handicaps recognized and overcome, might rank higher in income than any other professional body.

Medicine and dentistry are struggling arts. From the very nature of dentistry, it is obvious that to be a successful dentist one must have a mechanical mind. Surgical procedures are mechanical in that the surgeon must be conversant with all the instruments with which the operation is to be performed; nevertheless, dentistry requires greater mechanical

Read before the Section on Dental Economics at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 17, 1938.

skill than any of the allied professions.

To understand why I believe that the profession does not use all of the material available, let us look at our educational program. We do not know definitely whether the various students who make application for courses of study have mechanical sense, nor do we know whether this sense, if lacking, can be developed to such a degree that they will become efficient.

I have said that a successful business man utilizes all available material to make his work successful. He has heads of departments who are highly specialized to work out every detail of their departments, and his administrative ability is devoted to seeing that these heads are successful in their administration. No one would think of denying a successful business man the services of the certified accountant or the highly skilled stenographer, and no one would think of denying a manufacturer the services of chemists, metallurgists and highly skilled scientists in his experimental or developing departments. It is a part of his success to know what materials have in them and how he can best use them for his purpose.

And so in the practice of dentistry, exactly the same conditions exist. We should be surrounded by persons equipped to preserve the health of the patient and to maintain a working set of human teeth. Are we availing ourselves of the opportunities that are before us and have we the constructive imagination to avail ourselves of all these details to make ourselves more successful? I say no. And should we be denied the use of any group of specialists in any branch of constructive, preventive or health programs who are better enabled to administer health programs to the public under our supervision?

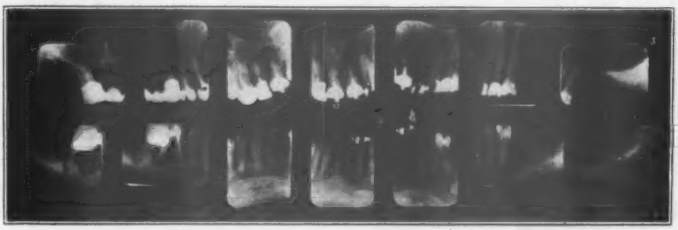

Fig. 1.—Roentgenographic study of comparative anatomy and pathology.

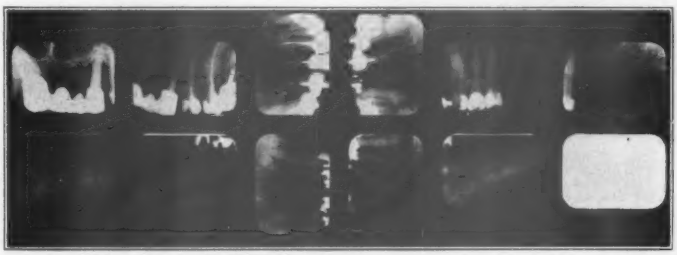

Fig. 2.—Inadequacy of the average dental roentgenogram.

If we have not constructive imagination and a definite plan of life, of necessity we are not interested.

A young man goes into practice with no constructive imagination, no ideals and no planned scheme of life. He starts out with a gross business of perhaps $4,100, and he will never have any more

than that. He is not open-minded and at the end of twelve or fifteen years of work, he is no better off than the day he started. He has not the constructive imagination to use the materials and methods at hand for his betterment. Are we to be denied the use of any materials or the services of persons who would help us in reaching a high efficiency if we have constructive imagination and a plan of life? We can carry this thought into the daily lives of individuals with whom we come in contact. There is nothing so pathetic as the man or woman who has no plan of life, who has not determined what makes happiness and how we are going to attain it.

PLANNING DENTAL OPERATIONS

The commonest fault at present is failure to plan dental operations. Study

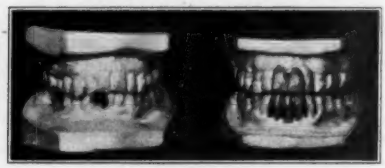

Fig. 3.—Occlusal deformities with corrections.

models, not faulty impressions that mean nothing, but models that are articulated and put to motion should be a part of diagnosis. How are these possible without trained assistants, without working models articulated to movement with all edentulous areas and correlated with remaining teeth, models that will permit the designing of structures to be put upon them instead of that work being left to a laboratory technician who does not know mouth conditions?

A study of cavity preparation is necessary to accuracy in this type of work, but without ample time to study these problems it is impossible to develop one's practice to its ultimate possibilities. The average inlay can be prepared and manufactured in one-fifth of the time that is actually used. Not a dentist practicing in a most remote section but could do better work, with a larger gross and net income, with smaller fees, if he were compelled to employ a dental hygienist to relieve him of operative details.

A set of roentgenograms in which all the teeth are alined in the mount for comparative study are shown in Figures 1 and 2. Without comparative study, we do not have the opportunity of visualizing normal and abnormal tissue. Here we note the uniformity of blacks and whites denoting uniform timing and penetration in exposure. We note positional accuracy and further the timing of developing to temperature. We note, in these roentgenograms, evidence of disease. We find an array of pulpless teeth; we find pockets around approximately every tooth, and clinically the examination reveals a flow of pus from every tooth. Occlusally, the mouth is a complete wreck. The patient wanted a partial denture attached to these diseased teeth, with not a chance of its being a success with the existing occlusion. The occlusal trauma in this case is evidenced by a complete overbite without overjet.

The patient, in 1930, consulted his local physician and local dentist, but was not satisfied, so he went to an institution for a checkup. The report in 1930 gave him a complete bill of health, with the exception that he was advised to have all upper teeth removed and as many of the lower as was necessary to eliminate obvious foci of infection.

This man took the advice given at this institution and dissuaded his physician and his dentist from doing anything to remove these foci of infection. The physician and the dentist deferred to his decision, with the result that seven years later, he was again in a run down condition. He hurried back to the same institution, only to find that he had a hopelessly diseased heart, which makes him a cripple for life. In my opinion, the dental profession, with the medical pro-

fession, was very largely to blame for this condition, in not being able to persuade this man, who knew nothing of dentistry, that the dental profession has definite ideas regarding infection, surgery and occlusion, and demanding that he submit to the eradication of this infection, as prescribed in 1930.

The practicing dentist who has the care of this (Fig. 1) or any other mouth must have constructive imagination, must have at his disposal the ways and means of safeguarding his patients from the ravages of disease. This mouth required constant supervision, and if the effort is persistent, invariably the patient will yield to authority or no longer consult the dentist.

Figure 2 is an example of the futile effort of the dental profession to interpret by photographs the disease present in this mouth. The dentist knew nothing about the timing of the x-ray film, nothing about timing the development of the film by control of the temperature of the developer and the fixer. He has no constructive idea of making a comparative study of these roentgenograms by providing a mount that will allow him to visualize the diseased or the healthy teeth. In other words, the whole effort is misdirected and useless. But a dentist does not have time to go into these details if he has constructive imagination and can teach associates to master intricate details and supervise the prophylactic and preventive measures which make for success or failure; and he fails utterly if he cannot keep a large majority of patients who have mouth infections from neglecting them until they become a serious health menace.

Let us consider another phase of the inefficiency of the dental operation. We are advised that we must safeguard our patients through a better knowledge of vitamins, foods and body chemistry. Are we doing it? We do not have a constructive, concise or practical method of applying and teaching these facts, nor have we agreed on any method to serve our patients along defensive prophylactic lines. We fail to master the mass of detail necessary to make our work successful.

Are we teaching prophylaxis in our practice? We are not! This I know by the number of mouths that I see every

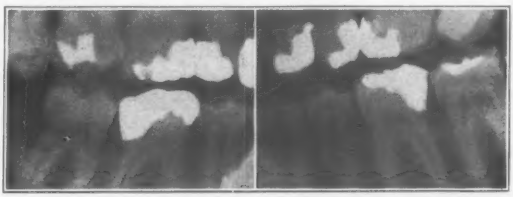

Fig. 4.—Bite wing roentgenograms illustrating caries.

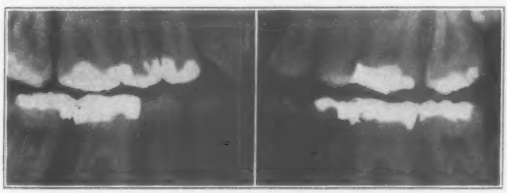

Fig. 5.—Bite wing roentgenograms illustrating caries.

day in which there is not the slightest evidence of effort to maintain a prophylactic condition.

A letter from a dentist in a distant city says:

I am giving from eight to twelve prophylactic treatments every day. I am giving a better prophylactic treatment than any other dentist in my state, but I have reached a point where I am denied the practice of any other type of dentistry because of the demand for my time for prophylactic measures, with the result that I must either devote the rest of my life to prophylaxis or I must restudy dentistry, get into the mechanical field of dentistry and definitely rebuild my practice, or I am lost. I must have a dental hygienist to whom I can turn over this vast amount of prophylactic work, and I must have the force of character to tell my patients that I now have a department of prophylaxis supervised by a capable and competent assistant who can take this off my hands, as I am busy with other types of work which do not allow me to devote all of my time to prophylactic work.

Last month, a patient with a broken down mesioclusodistal amalgam filling said: "I have just moved here from Illinois. This tooth has been filled and refilled a dozen times. Now what can you do?" The case calls for a mesioclusodistal inlay because of a close bite and excessive muscle pull. The work completed, I suggested a prophylaxis, which was much needed. This accomplished, bite-wing films were taken, which revealed deep decay under two teeth. In removing the decay, I purposely allowed the odor from these teeth to pass the patient's nostrils; the patient exclaimed, "Does that odor come from my tooth? Go as far as you like in removing anything you choose. From now on I have a very definite idea as to what is to be accomplished when my teeth are cleaned. If I change residence again, the next person who cleans my teeth will have something to work for, or I will know the reason why."

Dental education has provided an excellent entrée for the practice of dentistry. It is estimated that the cost of the six-year course in any recognized dental college entails an outlay of approximately $7,000 to $8,000. It would seem, then, that more men should avail themselves of the means of caring for the multitude of details which constitute a successful dental practice.

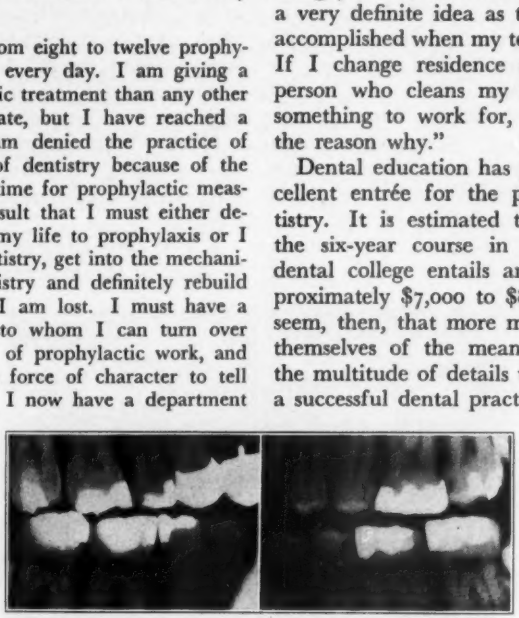

Fig. 6.—Bite wing roentgenograms illustrating caries.

THE DENTAL ASSISTANT

The first step in this direction is the training of the dental assistant, whose aid is imperative for successful dental operations. I use the word imperative and emphasize the fact that I do not believe it possible for any dentist to do skilful dental work without one to two dental assistants. And the dentist himself must have constructive imagination sufficient to so train these assistants that they are efficient. I do not believe it possible for any practicing dentist to progress without the aid of a hygienist, and above all, to fulfil the obligation implied in his dental degree by practicing preventive dentistry. Without a trained associate such as a dental hygienist, he is utterly helpless, as this branch of his

work should be delegated to her, just as the business man delegates his problems to the lawyer and the architect. The successful business man has his certified accountant, his chemists, his metallurgists, his stenographers, his cost man, his sales department, his supervisor of sales, etc. If he does not have these aids or has not the ability to procure them, or is denied by law their use, he is hopelessly handicapped in attaining the ideals he is striving for. Success in business is largely the result of executive supervision, the administration of the various departments in businesses, in the professions and in institutions. In one medical institution with which I am familiar, 1,995 full mouth roentgenograms were taken in one week. I was so impressed with the results of the technic that I inquired of the technician where he had received his

Fig. 7.—Hereditary and acquired deformities.

training. He informed me that his previous job was delivering milk, but he was ambitious and made application for a job in this institution. His assistant's previous job was tending furnaces and acting as handy man around yards. Does this not say to you that we are not utilizing the x-rays as we should, as a means of diagnosis?

In our office, with every prophylactic treatment, we prescribe two bite-wing roentgenograms as a precaution in diagnosis and for fear we may overlook a tooth in which decay exists and which the clinical examination does not reveal.

During the period between Christmas and New Year's, in twenty-four bite-wing films we found nineteen mesioclusal cavities that required attention before the patients returned to school. How can we safeguard the teeth of these young people without some method at our disposal to care for their mouths? Without organized prophylactic supervision, many such cavities are missed.

I have not touched on dental deformities. "Hereditary growths are patterns of the species," and shall we allow patients to pass through our hands day after day with incipient deformities apparent and not raise our hands to prevent or correct the conditions? Every dentist should study orthodontia sufficiently to recognize conditions demanding treatment.

I regret that I cannot impress a greater number with the opportunity that is before them. Perhaps we should adopt the medical aptitude test given during the past seven years by a committee of the Association of American Colleges. If prospective students do not have the mechanical or mental skill necessary to pass a medical aptitude test, perhaps they should be discouraged from acquiring a dental degree.

In Wisconsin, I was one of the pioneers who made it possible for the dental hygienists to be licensed. If I were to be denied the aid of the dental hygienist in my practice, I should be compelled to quit. She is more important in the administration of my practice than any one other human element. She is the buffer between the patient and the operator. She knows psychology and she prevents emotional outbursts. She soothes those patients who find difficulty in restraining themselves. She fosters the child clientele because she realizes that no practice can continue to be successful without the child patient. The hygienist watches over these patients and prescribes their home treatment and care. She discovers numerous carious cavities, especially through the use of the bitewing film. She saves the operator's time, allowing him to devote more time to the constructive features of practice, so important to success.

It seems unfortunate that organized dentistry should not sponsor the employment of the dental hygienist in every state. If I had my way, I should make it compulsory for every dental office of the approximately 60,000 dentists in the United States to employ a dental hygienist.

The average dentist does not like to do prophylactic work in spite of what he may say to the contrary. As a result he becomes careless, has no system of performing the work and is not paid adequately for the time spent; when, as a matter of fact, prophylaxis should be the greatest practice builder of all efforts in an organized plan in dentistry.

Our greatest difficulty in Wisconsin was to get organized dentistry to see the hygienist's possibilities and to go to our legislature to have her status legalized.

Many in this audience are thinking of abuses that would come with the hygienist and that was one of the big questions in the final arguments of organized dentistry in Wisconsin. There always have been abuses and there always will be abuses, in organized business, in organized professions, in organized society; but with the laws so specific, the opportunity is very small for the dental hygienist to do anything that is not prescribed by law.

IS THERE A PLACE FOR THE DENTAL HYGIENIST IN THE DENTAL OFFICE?

By Edgar H. Keys, D.D.S., St. Louis, Mo.

IN making a study of the present status of the dental hygienist, my first surprise in reviewing the literature was the number of articles published on this subject up to and including 1932, and the almost total absence of articles relating to this topic in the last five years. The dearth of literature on this subject in recent years has been attributed to the depression, the services of many hygienists having been dispensed with during this period. Consequently, there has been little discussion regarding them.

Following a review of the literature, questionnaires were sent out to the board officials of every state, also to other individuals and to institutions in an attempt to obtain a cross-section of opinion.

Read before the Section on Dental Economics at the Seventy-Fourth Annual Midwinter Meeting of the Chicago Dental Society, February 17, 1938.

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It is now twenty-three years since the first state legalized the status of the dental hygienist. Since that time, thirty additional states, Hawaii and the District of Columbia have adopted such laws.

Illinois has no hygienist's law; but as many as fifteen are employed in the public schools of Chicago, according to Salzmann,[1] who also states that 394 hygienists are employed in a total of 484 hospitals and that in Missouri five hospitals engage the services of six hygienists. I have been unable to verify the employment of any dental hygienists in Missouri hospitals. The State of Alabama does not legalize the status of the dental hygienist, but has a system whereby permits are issued. The state decides whether the dental hygienist can operate and with whom, and provides that the hygienist shall always work under the supervision of a dentist. If the dental hy-

gienist wishes to change employers, a permit must be obtained.[2]

The governments of New Zealand and Australia train dental hygienists or dental nurses for work among the children in the schools. The course is two years; there is no tuition fee, and the graduate is pledged to remain three years in the employ of the government after graduation. In Hawaii, a two-year course for dental hygienists was given at the Teachers' College, but this, according to A. R. McDowell, of San Francisco, Calif.,[3] has been temporarily discontinued. Mrs. George R. Carter, philanthropist, provided financially for the training of the Island's hygienists, and the course was given at the University of Hawaii. The position of dental hygienist is recognized in other foreign countries, and in some of these countries, the filling of deciduous teeth is included among her duties.

Since an array of graphs and tabulations can be found in the literature, only a summary of data will be given here. The earliest consideration of the dental hygienist was presented in a paper read January 1902 by C. M. Wright, of Cincinnati, Ohio. The next record in the literature is found in a paper presented before the Section on Stomatology of the American Medical Association in 1903, by M. L. Rhein, of New York City. Alfred C. Fones, of Bridgeport, Conn., who is considered the real father of the hygienist movement, inaugurated, in 1913, the first course for the dental hygienist. This was given in his office two years before the state legalized the practice. Dr. Fones' prime purpose was to train girls to give prophylactic treatments and to teach the value of preventive dentistry. Their work was to apply primarily to the public school.

A study of the laws adopted by the various states seems to indicate that they were not drawn up to encourage the dental hygienist, but to limit the field so completely that her work along these lines would be of little value. Some states admit both sexes, two make no reference to sex and the remainder admit only women. Fones believed that it was a mistake to license men, because they would, he thought, be more prone than women to abuse the privileges.

The dental hygienist's training ranges from one year in high school to graduation, and from three months' training under a dentist to two years in a dental hygienist school. Some states will admit a graduate nurse who has had three months' training in a school for dental hygienists. In certain states, dental hygienists are permitted to practice only in the offices of the dentists; in others, only in institutions, and in some, in both. In all cases, the dental hygienist is under the supervision of a dentist, and to practice independently is not permitted in any state. Although no state permits dental hygienists to practice independently, it is believed by some that the depression checked certain organized movements to carry their case before the legislature, the contention being that they would be just as capable of giving prophylactic service to patients in their own offices and at a lower cost than that charged by the dentist, who obviously shares in what the public pays for the service. Pennsylvania, in addition to eight months of special training, requires eight months of training under the supervision of a dentist. The State of North Carolina has been so conspicuously discriminating as regards credentials that there are no dental hygienists employed in the state. This is not without significance. The applicant has to hold a grade A teacher's certificate, issued by the department of education; must have a technical training, and can be employed only in public institutions and schools under the supervision of a dentist.

I have tried to learn from various sources in the states legalizing dental hygienists what good the public has derived

from their efforts. Ten state officials emphasized the importance of their endeavors to educate the public, particularly children. Three claim an economic advantage since many dentists find that prophylactic work takes time from the more remunerative features of their practice. Moreover, the dental hygienist can give this service at a reduced cost. Generally speaking, the public has not been taught to attach the same value to oral prophylaxis as to restorative dentistry. This is an argument which perhaps cannot be refuted; but whether the dental hygienist is the solution remains to be seen. Some express the belief that the dental hygienist educates the public as to the importance of dental care. One writer contends that the dental hygienist gives tone to the office. The argument is also advanced that the dental hygienist takes more interest in this phase of the work and is more skilful and more painstaking than the average dentist. One state board secretary states that the public is protected against unscrupulous people and the situation is better controlled. Another state board secretary believes employment of dental hygienists puts dentists on a level with physicians. I am willing to concede that the assistance of an attractive, neat, intelligent and diplomatic young woman certainly is desirable, but that her presence in a dentist's office is instrumental in raising the dentist to what some men believe to be the higher plane of the medical men is open to question. These rather ambiguous statements I shall not attempt to explain; for I am convinced that many of our profession do not suffer by comparison, in spite of the fact that they do not employ a dental hygienist.

One writer stresses the value of the hygienist in handling children. It seems that this point is a bit overstressed, since the dental hygienist is limited to cleaning the child's teeth, and the exposed surfaces only, which is, after all a comparatively negligible contribution to the handling of children in need of treatment. Many dentists consider the dental hygienist a co-worker rather than a substitute at a low fee. Strangely enough, many insist that the dental hygienist is capable of doing this work more thoroughly than the dentist.

I cannot agree with the men who contend that a young woman is naturally more skilful at rendering this type of service than the dentist. It is well known that in occupations and professions, some individuals enjoy the talent referred to as digital dexterity, but it is not a gift predominantly found in women. It is therefore ridiculous to presume that any young woman is more dextrous than a man in rendering this type of service. As the many claims regarding the various achievements of these young women are revealed by the literature and our correspondents, one may be a bit penitent to have been so lacking in recognition of these achievements. I quote Grace Rogers Spalding, of Birmingham, Mich., in a discussion of a paper on this subject:

> If in nine months they can receive instructions in anatomy, histology, physiology, bacteriology, chemistry, materia medica, psychology, general hygiene, nutrition, child hygiene, oral hygiene, public speaking, and learn the technical procedures in addition to handling dental patients and acquiring refined skill necessary to operating on the teeth and be given a degree which entitles them to act in the capacity of dental diagnosticians, then it is surely a mistaken idea that it is necessary for a dentist to spend six years to obtain his degree. One of the chief arguments for lengthening the dental course from time to time has always been that the dentist, while needing more culture, was yet more in need of a broader scientific foundation to make him a better diagnostician. In spite of the fact that medical nurses spend four years preparing for their work, and often take specialized training in addition, I have yet to hear of their appearing upon the program of medical societies, for as one physician expressed it: "Their training has been in nursing and not in medicine"; yet no one will question that the work of the physician and

medical nurse are interdependent. In fact within a year, one of Michigan's dental hygienists, in applying for a position, offered as one of her assets that certain well known citizens of Detroit would follow her as patients.

Another correspondent, a well-known dean, expresses himself as follows:

> There are no advantages to the public in licensing hygienists. Any advantage, in the segregated work she does, is as far below the value of the same work done by a trained dentist, as the quality of training of the first is inferior to the quality of the training of the second. It is assumed legally that prophylaxis is a part of the dentist's work for which he is adequately trained. The argument that the hygienist does the work better than the dentist is to conclude one of two things: Either the standards fixed for educating dentists are too high since his duties may be discharged better by one of inferior training, or else dentistry's lack of interest in oral hygiene suggests that it should be taken away from the dentist entirely and placed in the hands of an interested, competent, autonomous group. Practically every argument used in support of the hygienist is an indictment of the dentist.

In most offices, the rôle of the prophylactician and office propagandist has been considered too limited to justify her employment; hence, the recommendation that she make full mouth roentgenographic examinations, do bookkeeping, pour models, take up ceramics, sterilize instruments, develop films, assist in laboratory work and perform innumerable duties limited only by the stretch of the imagination.

Now let us attempt to analyze the field of usefulness of the dental hygienist. To begin with, as has been stated before, the dental hygienist is permitted by most states to clean only the exposed surfaces of the teeth. It is generally agreed that this is a service of least value, as any prophylactic service that does not include removal of subgingival deposits is almost a negative service. One periodontist explains that the accepted method of treating pyorrhea is a surgical one, consequently all surfaces requiring attention are exposed. Many others indicate that this provision of law is hair-splitting and should be ignored.

A friend of mine in the South considers his dental hygienist a valuable adjunct to his office. I asked him how he reconciled the type of service that he stands for and the limitations specified by his state law. His reply was:

> That part of the law denying the dental hygienist the privilege of subgingival scaling is not observed. If it were, the hygienist could not do justice to her work. I allow my hygienist the privilege of removing deposits in normal gingival crevices, and any other privilege to thoroughly clean the patients teeth, which usually takes about an hour. She is not allowed to treat pyorrhea or any diseases or infections of the mouth.

A few states permit the dental hygienist to work under the free gum margin; other states, to recommend mouthwashes. Others still permit the administering of general anesthesia, and postoperative treatment following surgical procedures, and some states permit the hygienist to remove overhanging margins of fillings. We have been unable to learn what system is followed by the dentist in giving the patient complete prophylactic service. We do not know whether he precedes or follows the dental hygienist with the proper scaling. In any event, he has escaped only a part of this "undesirable work"; or the patient has been poorly served, or the dental hygienist has "fudged." The other field of usefulness of the dental hygienist, and the one generally considered the more logical, is that of dental health propaganda. Harold J. Leonard says[6]:

> Let us encourage public schools and hospitals to incorporate them into their organization, and let us make their courses of training such that they may be a credit to the dental profession that sends them forth,

that they may be able to hold their own with other educational and health workers, and that they may be scientifically prepared to take the new facts on which a preventive program can be based, as they are discovered, and use them in protecting our public from the greatest single disease scourge of our time.

Dr. Leonard certainly has the proper perspective; but have the schools and the dental hygienists measured up to his requirements? Although there are exceptions, I believe that, on the whole, they have not. I question whether the dental profession is basking in any reflected glory when the gospel of dental health is being promulgated by persons who are educationally deficient. The dental profession suffers an irreparable injury when encouragement is lent to the entry of young women with an educational background consisting of one year in high school and eight months' technical training, into the teaching ranks with men and women holding professional degrees and teachers' certificates. The dean of one of our older schools covers this point:

> There is no one now in our state sympathetic toward the dental hygienist as far as I know. Leaders in public school education have waived the question aside with the statement that they will not recognize any one as a teacher with such meager, incomplete and desultory preliminary training as that prescribed for training the dental hygienist. Because of this attitude, she could not get into the public schools on the pretence of being a teacher, if the state were full of them.

In many of the public schools admitting the dental hygienists, they are met with open hostility. I again refer to the North Carolina dental law; and I believe that these young women will fill a genuine need if their requirements conform to the ideals set up by North Carolina.

From states that have legalized dental hygienists come expressions of regret. One of the leaders in the dental profession who was once an ardent champion of the dental hygienist is now bitterly opposed to her employment. Incidentally, his state has never legalized the hygienist. One secretary of an eastern state predicts that further legislation will be imperative to keep dental hygienists under control. Secretaries from thirteen states believe that the sentiment is unchanged in favor of the dental hygienist. I am ready to admit that in the past twenty-five years none of the greater forebodings have been realized; but does twenty-five years' experience furnish a true index?

It required about seventy-five years of organized effort and lavish expenditure of money to bring about prohibition, and another fifteen years to repeal it. This may seem far-removed from the topic under discussion, but I am merely attempting to show that our past twenty-five years' experience need not necessarily be considered proof of the hygienist's value. Many believe that the concession to employment of the dental hygienist is an entering wedge of more portentous things to follow. If the hygienist is ever permitted to practice independently, unquestionably the same privilege would soon be given to laboratory technicians.

Milburn Colvin, secretary of the dental board of Washington, D. C., states that litigation is pending in their courts on this issue at the present time. The decision has not yet been rendered.

The same board cited one dentist for permitting his dental hygienist to practice dentistry. The dental hygienist turned state's evidence, and the dentist was proved guilty and his license was revoked. Minor J. Terry, secretary of the New York Board, reports that in twenty years eight or ten hygienists were summoned before the Grievance Committee on disciplinary proceedings. They were accused of pernicious activity in their attempts to attract a clientele. Another secretary (in Pennsylvania) reports that dental hygienists have practiced, until stopped, in department stores and

beauty parlors. In Wyoming, one dental hygienist was found operating in a beauty parlor, but ceased doing so, without any resistance, when the matter of law violation was called to her attention. She was, however, quite impressed with what she believed to be an opportunity in this field.

Instances are reported wherein an employer found it necessary to dispense with the services of his dental hygienist because of her attitude. In some of these cases, after dismissal, she called many of her former employer's patients on the telephone and otherwise came in contact with them, in an effort, which was not altogether unsuccessful, to secure his patients for her new employer.

A number of state officers were asked whether they considered the licensure of dental hygienists a forward step in preventive dentistry. Seventeen replied in the affirmative, four in the negative; five thought it questionable, and one was of the opinion that the proper place for the hygienist is the institution and the school. Many accusations are made of law violations, but the insignificance of these violations or the difficulty of proof has permitted them to go unnoticed. Seventeen secretaries report that no abuse or violation of the law has come to their notice.

Can 51,000 dentists be wrong? Thirty-one states having a dental population of this number, with an American Dental Association membership of 27,447, have approved the dental hygienist. What does this signify? It is well known that an aggressive minority is a much more formidable group than the average lethargic majority.

Some of the secretaries of the state dental societies report that as few as 25 per cent of the membership actually approved the hygienist law; others estimate the percentage as high as 90.

Have dental hygienists turned out to be the Aladdin's Lamp in dental health service and practice building prophesied by their progenitors? I believe that they have not—it would be too much to expect. Nevertheless, some communities find their public health efforts constructive and progressive. Has there been a serious encroachment on the part of the dental hygienists on the prerogatives of the dental profession? Have any of the dental laws been emasculated through their efforts? It may be truthfully said here that the abuses of privileges and violations of law generally anticipated seem little in evidence when compared with the number of violations by the members of our profession, and, in most instances, when dental hygienists have violated the law, they have done so with the permission or the encouragement of the dentist. This leads me to believe that the states which have little control over advertisers are surely placing in the hands of advertisers an effective device for further defrauding the public.

The dental hygienists have a national organization and publish an official journal. A perusal of the journal certainly indicates nothing but idealistic aims and a determination to cooperate with the dentist. Miss Mary Mikalonis, in her report of the Wisconsin Dental Hygienist Association, writes[7]:

> I do not want to be boastful, but I would like to mention that our program was par excellent. It contained no trade house education, which I, personally, feel should not be tolerated by any profession.

Many of our members should take cognizance of the principles expressed in her report and would do well to emulate their example. The original dental hygienist was trained to be a specialist in the office of the dentist. In order that she might survive to any extent, she has unwillingly accepted the general duties of an assistant. One of the familiar arguments in favor of the dental hygienist is that she can give a needed service far

more economically than the dentist can. Perhaps this is true of older men having large clienteles, but I challenge the accuracy of the statement as applied to young men who struggle for some years, generally speaking, before they earn a fair living.

In St. Louis, we have ten municipal dental clinics, employing twenty men, who give five to five and one-half days weekly for the munificent sum of $87.50 a month (and there is always a waiting list of applicants for these places). These men have graduated from high school and have had one or two years in college. Some have bachelor degrees plus their four years of professional training. Would not their background better fit them for any type of dental health service than that of the dental hygienist with one year in high school and eight months of technical training fits her? Now, what of schools that are graduating dental hygienists? According to a survey conducted by R. P. Thomas, of Louisville, Ky.,[10] these thirty-one states, not counting Hawaii, have issued a total of 6,238 licenses, but, in the same states, 2,603 licenses are in force, a loss of 3,635.

There is no way of determining how many of this number are still rendering hygienists' services without renewing their licenses, how many are married or how many have dropped by the wayside. The number of licenses issued to dental hygienists range from two since 1921 in Wyoming to 2,128 since 1916 in New York. Massachusetts reports having issued 927 licenses, with 250 in force. A prominent educator in a Western state makes this observation:

> I note that there is not any considerable demand for hygienists from the dentists in this community, and that in most instances the hygienist pretty nearly has to develop her own job through the board of health or the boards of education. From the number of licenses that have been forfeited in our state, I judge that a great number of the young ladies register for the course in dental hygiene just because they must register for something, and then after discouragement in trying to secure employment or realizing they have attained the marriageable age, get married and assume the responsibility of wife and mother. I should imagine that any one who examines the situation very closely would hesitate to recommend that this course be taken, because of the advancing requirements and the meager opportunities afforded in this field as compared with the opportunities as a practitioner of dentistry.

W. A. McCready, of Pennsylvania, reports that since the act was passed in 1921, about 650 dental hygienists have been licensed, and that less than 400 are still registered and not more than 250 are in active practice. More than 3,000 have been graduated in the past ten years. Between 350 and 400 were graduated in 1937. One correspondent maintains that the dental hygienist is promoted, beyond any actual need, by men engaged in dental education, to increase the income of the dental department of any university.

The schools, if they accept these young women without giving them a clear and truthful picture of what their prospects are, may well be accused of gross insincerity and rank violation of all the ethical concepts they are supposed or pretend to inculcate in their students. There can be no justification for enrollment of these students unless they are frankly told that their training is to prepare them for general usefulness in the dental office. Incidentally, three of the schools are in states which do not license hygienists; therefore, the state that graduates them offers them no field for operation. One dean writes of the probability of closing his school for hygienists permanently. The reasons given are (1) not more than 50 per cent of them are good students; (2) many of the good ones soon marry, and (3) the inefficient ones attract a great deal of criticism to the course. He thinks that the ambitious ones who have personality and the proper fundamental

training are better assistants than those lacking these attributes.

In approaching this study of the dental hygienist, I have earnestly endeavored to keep out preconceived ideas and prejudices of my own. This survey might have been more illuminating and convincing had it included a greater field. I believe, however, that the following conclusions are logical: 1. Over a period of twenty-five years, the dental hygienists have been mostly a law-abiding group. Their digressions have been less in evidence than those of our own profession. 2. If they are naturally fitted for the work, they may acquire all the necessary skill to render satisfactory prophylactic service. 3. In many offices where there is insufficient need for an associate dentist, and certainly none for dental hygienists as specialists, they may be extremely helpful by combining prophylactic service with general office routine. 4. They would be most useful to the orthodontist, who must give strict attention to the oral hygiene of his patients; but here again, I am of the opinion that the orthodontist with a large clientele should associate with himself one of the promising young graduates who are especially interested in orthodontia. These young associates can be made laboratory technicians, prophylacticians and photographers, as well as operators at the chair. 5. I must discount to some extent the great significance attached to a dental hygienist's service in public schools, especially among the large group of underprivileged children. Wherever any educational activities are projected for the benefit of underprivileged children, provisions should be made for further free dental care. Unless this is done, such educational activities of the dental profession are not altogether altruistic.

Finally, I do not concede that the dental hygienist should supersede the dentist in the field of educational work. We are sometimes shown statistics which seem to indicate that there are an insufficient number of dentists. A careful observation in the larger communities, and a conference with the credit men of the supply houses, would seem to indicate a shortage of patients rather than of dentists. Therefore, it would, in my opinion, be far better that the dental schools give elective courses that will fit graduates for this educational service, and in this way open a wider field for the young men.

After three years of observation, the faculty of a dental school should be able to recognize the type of student especially fitted for public dental health work. Personality, appearance and cultural background should be requisites. An elective course should be provided in the senior year, including psychology, public speaking, food chemistry and some knowledge of general health work. Perhaps better still would be one year of postgraduate work. For this postgraduate course, a degree of bachelor of science in dentistry might be conferred or a certificate of training in public dental health work awarded. Neither progressive dental health service nor success in private practice is dependent on the existence or activities of the dental hygienist.

BIBLIOGRAPHY

1. Salzmann, J. A.: Principles and Practices of Public Health Dentistry. Boston: The Stratford Co., 1937.

2. Miller, R. H.: *Bull. Missouri D. A.*, 12:16, February 1932.

3. McDowell, A. R.: Status of Dental Hygienist in Field of Dental Health Service. J.A.D.A., 19:2033, November 1932.

4. Garvin, M. H.: *Am. D. Surgeon*, 49: 365, August 1929.

6. Leonard, H. J.: Teaching Preventive Dentistry in Colleges of Dentistry. J.A.D.A., 13:1101, August 1926.

7. Mikalonis, Mary: *J. Am. D. Hygienist A.*, 11:18, January 1937.

8. Thomas, R. P.: Dental Survey. J.A.D.A., 25:153, January 1938.

9. Algorn, J. F.: Reviews of State Laws.

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INDUCTION AND MAINTENANCE OF ANALGESIA WITH NITROUS OXIDE AND OXYGEN

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ANALGESIA means the absence of sensibility to pain, or a condition in which pain-producing stimuli are inhibited without loss of consciousness, a state in which the patient knows what is going on and may respond to directions from the anesthetist and the operator. This article is confined to the production of such a condition by means of nitrous oxide and oxygen.

Analgesia by means of nitrous oxide and oxygen is now extensively utilized in all minor operations on the teeth, in normal obstetric cases, painful surgical dressings, etc. Its use has done much to alleviate that mental state called "fear of the dentist," and it has helped dentists to do much more thorough cavity preparation for non-cooperative, apprehensive, nervous patients in whom the fear of pain is at least as enervating as pain itself.

Analgesia may be prolonged indefinitely with safety provided the nitrous oxide and oxygen are under such perfect control that the patient can at no time inspire more than just enough to maintain the desired state. This depends on the skill of the anesthetist.

With nitrous oxide and oxygen, analgesia occurs in what would be the first stage of general anesthesia with the same gases, and is two full stages short of general anesthesia, or loss of consciousness (the second, or excitement, stage and the third, or anesthetic, stage), and three steps away from the fourth, or asphyxial, stage, the last being the danger line. The proportion of nitrous oxide and oxygen for analgesia is approximately 75 per cent nitrous oxide and 25 per cent oxygen. Different patients require different mixtures, and the type of apparatus used may necessitate a slight change in percentage of the nitrous oxide and oxygen.

The technic for administration of nitrous oxide and oxygen to the state of analgesia, although uncomplicated, requires the mastery of a few details to assure uniformly satisfactory results. A thorough understanding of the physiologic action of the gases is also essential to determining what is occurring in the patient's system at any given moment.

Food should not be taken for three or four hours before administration. The kidneys and bowels are emptied and tight clothing is loosened just before the anesthetic is administered. The patient is comfortably seated with the headrest well forward to discourage oral respiration. A saliva ejector is placed in the mouth to prevent accumulation of saliva while the operator is at work.

The induction and maintenance of analgesia require less nitrous oxide and more oxygen than are used in general anesthesia. The gases are delivered at the rate of one gallon per minute. In general anesthesia, a flow of not less than 3½ gallons per minute of the combined gases is maintained. In analgesia, much air is inspired, as the mouth is open and uncovered during the entire procedure. This acts as a diluent of the nitrous ox-

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ide. Despite the ingress of air, however, pure oxygen is quite essential to safe analgesia, as the amount of oxygen obtainable from atmospheric air is insufficient to eliminate the hazard of asphyxia. When pain is felt, the patient is directed to breathe through the nose. This will tend to maintain the desired analgesia. If the patient does not respond to directions, more oxygen is administered.

ASPHYXIA

Asphyxia, broadly speaking, may be defined as a suspension of animation due to the presence of an insufficient quantity of oxygen in the respiratory and circulatory systems, or to an oversupply of carbon dioxide. The cardinal asphyxial symptoms are cyanosis, rapid respiration, dilation of the pupils, ashy pallor, slowing of the pulse, convulsions and elevation of the blood pressure (which may be determined by use of the blood pressure apparatus). The color of the patient may be misleading, for normal color may be present while the patient has all the symptoms of asphyxia. The sum of all available signs is the determining factor in diagnosing a state of asphyxia.

It is impossible to state generally with any degree of accuracy how much oxygen is necessary to eliminate or avoid asphyxial symptoms. Even in a given case, one cannot determine, without first experimenting, the exact percentage of oxygen that the patient will require to avoid overstepping the borderline of asphyxia. Alcoholics, obese patients, those suffering from cardiac or renal disease, etc., will require from 12 to 25 per cent or more of oxygen; normal patients will require less. Each case, however, must be experimented with for a few respirations to determine what is best. It is far better to give too much oxygen than not enough. There is no harm inflicted in administering too much oxygen. The truth of this statement can be verified by inhaling the contents of a tankful of oxygen, not the slightest sensation of excitement or deviation from normal resulting.

The total amount of oxygen delivered to the patient should be equivalent to or more (but not less) than the amount of oxygen normally contained in respired air; namely, 20 per cent. A patient under analgesia with the mouth open usually inspires one-third nitrous oxide and two-thirds air. The air, of course, has its ingress by way of the open mouth. The patient is therefore using 13 per cent of oxygen from the combined gases (i.e., nitrous oxide and air); which makes it necessary to add not less than 7 per cent of pure oxygen to bring the total amount of oxygen inspired up to the normal of 20 per cent of the gross intake. Instead of using air and oxygen, oxygen alone may be used with nitrous oxide, with equally good results; but this is impractical because the mouth must be open during operative procedure, and this does not permit use of the mouth pack, especially in persistent mouth breathers. The respiration of air may be reduced with the aid of mouth packs wherever practicable.

One of the first symptoms of analgesia is a tingling of the fingers and toes. This is followed by a full feeling in the head and ears, thumping in the ears, a feeling of thickness of the lips and a sensation of warmth over the face and even the entire body. The voice is thick and sounds far away. Teeth snapped together under analgesia sound like rubber or wooden teeth coming together.

There is a point at which the patient can taste the anesthetic, and a little later he can smell it, after which he commences to feel its effects. Patients who are more susceptible often miss the sensation of taste. After the sensation of warmth comes a droning sound like a fleet of airplanes at great height. The voice now is thick and guttural. A patient at this point often has a decided sense of humor. He may perspire freely.

If it is suggested that he laugh, he will comply with the request. A patient in this mood is thoroughly cooperative. He may be instructed to pinch himself, and if he does not feel it, the operator may proceed.

While the patient is taking the nitrous oxide and oxygen, a feeling of pleasant anticipation and confidence may be created by the anesthetist's predicting the various symptoms; first, the sensation of comfortable warmth. When the patient tells you that he feels warm, tell him what he is to expect next—a tingling of the fingers and toes. In this way, the patient will see that the anesthetist knows what is occurring, and his confidence will be increased greatly. It is suggested to him that he breathe deeply through the nose if he has pain; that he breathe deeply through the mouth if he begins to fall asleep. At intervals during the operation, he is asked to expectorate into a pus basin, placed under his chin to avoid movement on his part. The patient should not be permitted to swallow any of the débris, as this will cause nausea.

As stated before, after about two minutes of administration of the gases, the patient is asked if there is a feeling of numbness or giddiness and a tingling sensation in the toes. Now the test for pain is made. If there is pain, the air valve of the inhaler is closed and the patient is allowed to take several inspirations. Gradually, the valve is opened again until the proper adjustment is reached for the patient's requirements. The depth of analgesia may be varied by increasing or decreasing the percentage of oxygen delivered through the inhaler and by asking the patient to breathe only through the nose. If there is persistent mouth breathing, the exhaling valve may be closed completely. If the patient passes into light anesthesia, the percentage of oxygen supplied by the apparatus is increased.

Variable methods must be worked out to meet the requirements of each patient. The fearful patient will attempt to take the inhaler himself to experiment with it, to gain confidence. The curious patient will wish to take nitrous oxide and oxygen to all of the stages of anesthesia for the experience. The sleeper will have the idea that he can take a nap while the operator is at work. The stubborn patient will do the thing you do not want him to do—breathe through the nose when instructed to breathe through the mouth, and vice versa. Before any attempt is made to do actual work, it is often a good plan to allow the patient to take the nasal inhaler and respire through it for three or four breaths in order that he may experience the sensation which has been outlined to him. If the rubber dam is used, the patient is instructed to raise a finger to indicate pain.

The patient is anesthetized too deeply when (1) respirations become exaggerated and inspirations become much longer than expirations; (2) he makes unruly movements; (3) his eye takes on a hard look and the pupil begins to dilate and (4) he closes the mouth, does not open the mouth when so instructed or goes to sleep, when he has passed into the second (excitement) stage or the third (surgical) plane. There is seldom need for surgical anesthesia in dental operations other than extraction, pulp extirpation, apicoectomy, removal of cysts, etc. The anesthetist should be alert to recognize these symptoms, and the patient, if not yet asleep, should be instructed to breathe deeply through the mouth. If he does not respond to these directions (and he will not if he is much past the analgesic stage), the oxygen percentage is increased or the nasal inhaler raised until consciousness is restored and the patient again assumes the lazy, languid attitude with blinking eyes characteristic of the analgesic stage. If there is pain, the patient is instructed to breathe through the nose. A few deep breaths will suffice to carry him back to

the analgesic stage. If pain is felt despite this, the nitrous oxide percentage is increased.

Analgesia is based on the phenomenon that the first special sense to surrender under nitrous oxide and oxygen administration is the sense of feeling (pain), leaving the other special senses less influenced, but influenced nevertheless. Loss of consciousness is considered the dividing line between anesthesia and analgesia, but one merges so gradually into the other that when the patient's eyes are closed, it is impossible to determine, without first testing the reflexes, the exact moment when consciousness is lost. For this reason, the patient should be instructed to keep the eyes open at all times and try not to fall asleep.

The depth of analgesia obtained is in proportion to the concentration of the nitrous oxide in the nitrous oxide-oxygen-air mixture, and this imperceptible passing into anesthesia is put to practical use in obtaining mental lethargy as well as to preclude the various intensities of pain. The most satisfactory analgesia is obtained when the nitrous oxide is diluted with just enough oxygen and air to prevent loss of consciousness, yet is of sufficient concentration to abolish all pain reflexes.

A difficulty which confronts the anesthetist in analgesia is the handling of all types of patients. In this undertaking, the utmost tact and the ability to inspire confidence are two important factors in success. The average patient will cooperate with the anesthetist if properly approached.

In commencing analgesia, it should be explained to the patient that there will be no loss of consciousness, that he will be cognizant of the operation but will suffer no pain. The patient is requested to inform the operator should he experience any discomfort, and it is explained to him that if any pain is felt, the anesthetist will carry the analgesia to a point where pain is entirely abolished. In this manner, the patient's confidence may be gained, and thus the fear of pain, which very often persists in the mind of the patient when pain itself is absent, will be greatly minimized. Under these conditions, the average patient will remain calm. Patients with hysterical tendencies may be demonstrative to the point of rendering the operation impossible of performance until anesthesia is carried to the surgical plane. To this, there can be no objection if analgesia does not suffice. If analgesia is present at all, its tendency is to lessen the sensation of pain even though the operation is commenced before ideal analgesia has been induced. To what extent pain will be diminished will depend on how far the analgesia has progressed toward complete absence of sensation. If the operation has been painless, nothing is left to be desired, even though ideal analgesia has not been produced. The patient has still been rendered a service in proportion to the diminution of pain.

Caution should be exercised in the care of inhalers and breathing tube to preclude carrying infection from one patient to another. Bathing the inhaler and tubing in 1:5,000 mercury cyanide solution for a few minutes, rinsing them in water and using them with the inside of the tubing wet will prevent contamination and will insure a dust-proof and germ-free gas.

Just a word on the limitations of analgesia: The removal of a vital pulp, the extraction of a tooth or the performance of minor surgical operations such as the removal of cysts and apicoectomy, should not be attempted under analgesia, as, in most cases, it will result in failure. Nor will analgesia miraculously transform a hysterical patient into a calm one unless the anesthetist can first secure that cooperation which comes with confidence in the dentist.

The following case reports may serve

to acquaint the general practitioner with the subjective symptoms of analgesia.

REPORT OF CASES

CASE 1.—Dr. E. I. McKesson, the patient, described his sensations as follows: "While undergoing analgesia for cavity preparation, I took great care in making a mental record of the sensations experienced. After I had taken four breaths of nitrous oxide and oxygen, a wave of warmth passed over me, followed in two more breaths by huskiness of the voice; which, in turn, was followed by a sensation of thickness and largeness. At this moment, the bur was applied to the cavity, but the tooth was still sensitive. During the next eight or ten breaths, a slight tingling of the skin developed, with a tired, relaxed feeling. In order to test the progress of analgesia, the doctor requested me to bite my finger. We both noticed that it missed my mouth, and I found that the finger was numb, so the doctor began work. At the point where the pain had been sharp before, the bur now gave a sensation of warmth which was not disagreeable. As analgesia deepened, the doctor seemed to be farther away, and the sounds, which a moment before were exaggerated, now seemed to subside. At this moment, the air valve was opened a little wider to prevent further advance of analgesia. Now I had developed a general feeling of numbness, apathy and indifference. Even the sensation of warmth was now completely suppressed, although I answered questions and was perfectly rational. Time passed slowly."

Dr. McKesson describes another experience with the analgesic stage:

At another time, I took nitrous oxide and oxygen nearly to anesthesia (without loss of consciousness) for the removal of adenoids.[1] I had decided to inhale the anesthetic until the panels of a door which I was looking at became blurred, and at that moment remove the face inhaler, hold my breath so as not to dilute the analgesic and open my mouth for the operation. I felt a pressure on the posterior pharyngeal wall from the curet, and later the warm blood running down my throat, but there was no pain whatever and I recovered completely in about five minutes. In this case, I was nearly anesthetized, since my sight, one of the last of the special senses to surrender to anesthesia, was affected.

CASE 2.—The patient, a psychologist, described his sensations as follows: "The experience of undergoing analgesia was rather interesting and not at all unpleasant. The anesthetic takes effect very rapidly. Within a minute or so, I felt a tingling in my fingers; then I began to lose the feeling of weight and was scarcely conscious of the chair I was sitting in. At the same time, the sensations in the outskirts of consciousness (such as the noises in the street and voices in the next room; in fact, anything except that on which my attention was immediately fixed) became remote and confused. The doctor began to operate on the tooth as soon as it was thought safe and his associate instructed me to raise my left hand every time I felt the least pain. I had slight twinges of pain when the work was started, but they were no more severe than those incidental to most operations in dentistry, and I should not have thought of mentioning them if I had not been instructed to indicate every sensation of pain no matter how slight. A few deep breaths of the anesthetic served to lessen the pain still more, and the final operation caused no more discomfort than a twinge of pain about like a sharp needle prick. When I was deeply affected by the anesthetic, I began to shake with laughter. The doctors, I knew, suspected that I had gone over the verge of consciousness and was in the hysterical stage of analgesia, but this was only partially true. I still understood perfectly all that they said, and I was able to respond promptly to commands to open my eyes or clench my fist. I was also perfectly clear in my own mind as to what I was laughing about, though I doubt if the joke would have seemed so funny without the anesthetic. This was what amused me: I knew that I was near the point of losing consciousness and nevertheless I could still feel slight twinges of pain. I thought it would be such a joke on the doctors if I reached a point where I could not respond to their instruction to indicate sensations of pain by raising my hand, but could nevertheless still feel the pain. It seems to me now that the

1. It is not now considered good practice to operate on adenoids under nitrous oxide and oxygen analgesia.

joke was decidedly on me, but, at the time, the idea of the doctors victimizing a helpless patient who felt pain but could not say so seemed to me a very absurd outcome to the experiment. I suffered a little nausea after the analgesia, but this was doubtless due to the fact that I forgot the doctor's instructions to eat an early and a very light lunch, and instead I ate a late and a very substantial one."

CASE 3.—The patient, a physician for whom four cavities were prepared in twenty minutes, jotted down the following details himself almost immediately after he left the dentist's office: "After giving my colleague who administered the gas an opinion as to the fit of the mask, I began to smell the gas. This was soon followed by a tingling sensation and I remarked an acceleration of heart beat. This was at once followed by a sense of warmth, which I regarded at the time as vasomotor relaxation. Then external stimuli of a slight character caused no pain. Gentle application of the bur caused no pain to otherwise very sensitive teeth. More severe applications caused a slight sense of pain, which led to reflex muscle movements. I indicated my sensation to the anesthetist, because he told me to breathe deeply. I thereby learned that by increasing the depth of my breathing, I could abolish the realization of pain at will. I was conscious of the dental manipulations and could readily respond to directions given me. There was at no time any sensation of suffocation or discomfort. During the entire process, I was capable of clear reasoning and made mental note of the sensation to report them to the anesthetist. For instance, I was impressed with the clear line of demarcation that separates the realization of outside impressions such as pain, from reasoning ability. At the time, I thought of a curtain as separating these centers as the best illustration, one or two breaths being sufficient to draw the curtain between the reasoning centers and those which had to do with the perception of pain. As the induction of the states of analgesia and anesthesia depends somewhat on the mental state prior to the administration, I may say that I was not in the least apprehensive, having taken nitrous oxide and oxygen on previous occasions to the stage of general anesthesia, and having absolute confidence in the ability of the anesthetist. Although I have emphasized that, during the entire time, I could reason, there was confusion once; namely, when the nitrous oxide was discontinued, and all the mental processes reestablished themselves in what seemed to be confusing rapidity. After the analgesia, there was no nausea, headache nor other ill-feeling, but there was a not altogether pleasing sense of exhilaration, which passed within twenty minutes under the influence of a good cigar."

CONCLUSIONS

1. Analgesia with nitrous oxide and oxygen eliminates pain in most cases and diminishes pain in all cases.
2. It is safe even in prolonged administration.
3. It is almost always a failure when used for apicoectomy, the removal of cysts or vital pulps, etc.
4. The proportion of the gases varies in every case, with a minimum of 12 per cent.
5. The assistance of a skilful anesthetist will simplify the operator's work immeasurably.

BIBLIOGRAPHY

MCKESSON, E. I.: Nitrous Oxid. Toledo: 1914; *D. Summary,* 34:208, March 1914; 33:233, March 1913.

HARTZELL, T. B.: *D. Cosmos,* 59:37, January 1917.

PRENTISS, E. B.: *D. Cosmos,* 57:156, February 1915.

SALZER, MOSES: *D. Summary,* 34:482, June 1914.

SELDIN, H. M.: *D. Cosmos,* 72:458, May 1930.

ALSIP, H. S.: *D. Rev.,* 29:1131, November 1915.

BACKUS, W. M.: *D. Summary,* 35:58, January 1915.

BEAR, M. W.: *D. Digest,* 21:221, April 1915.

DALTON, V. B.: *D. Summary,* 38:841, November 1918.

EVANS, J. H.: *Am. J. Surg.,* April 1916.

FELTUS, H. J.: *D. Summary,* 35:402, May 1915.

FRANKEL, JULES: *D. Cosmos,* 65:1203, November 1923.

FREEDMAN, P. J.: *D. Items Int.*, 53:515, July 1931.
MORGAN, W. N.: *D. Summary*, 36:408, May 1916.
MUNDE, ERICH: *D. Digest*, 19:623, November 1913.
RUBINSTEIN, M. N.: *D. Items Int.*, 58:475, June 1936.
WOODMAN, J. B.: *D. Survey*, 10:28, August 1934.
SCHNITZER, JESSE: *D. Digest*, 41:129, April 1935.
SELDIN, REUBIN: *D. Items Int.*, 57:403, May 1935.
SCHOHET, H.: *D. Items Int.*, 50:370, May 1928.
SIEGEL, C. I.: *D. Items Int.*, 56:430, June 1934.
TAINTER, G. W.: *D. Summary*, 35:493, June 1915.
TUCKEY, H. A.: *D. Cosmos*, 59:400, April 1917.

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RELATION OF GINGIVAL INFECTION TO ARTHRITIS

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THE purpose of this paper is to present to the medical and dental practitioners a point of view of the relation of septic foci in the gingival sulci to arthritis. Gingivitis is an inflammatory disease of the gum tissue beginning at the base of the gingival sulcus. It is believed that the inflammation is caused by micro-organisms, which because of their numbers or because of lowered vitality of the gum tissue, penetrate the epithelial lining of the sulcus and grow in the subepithelial connective tissue. The micro-organisms chiefly concerned are *Streptococcus viridans, Staphylococcus albus* and Vincent's organisms. Gingival diseases are quite generally disregarded as a source of systemic disturbance, yet they may be septic foci of greater significance than pulpless teeth.

The antiquated theory that the drainage of pus prevents infection should be revised to the rational theory that the drainage of pus indicates a chronic infection which has overcome the natural resistance and demands corrective treatment. The drainage is neither constant nor thorough, and if it were, why, since a chronic suppuration would not be tolerated elsewhere, should it be allowed to persist in the mouth?

There are many of us in the medical and the dental professions who are still not fully awake to the importance of preventing gingival infections, and there may be some among us who are not yet aware of the relation of gingival infection to systemic disease. When we realize that there are foci existing without warning symptoms in patients suffering from infectious arthritis and that these septic foci may act as a direct or contributing cause of joint disease, we cannot but feel that we are overlooking an important etiologic factor.

ETIOLOGY

When the mouth is in a poor hygienic condition, food débris is retained about the teeth, fermentation takes place and bacterial flora are greatly increased. When this condition exists, certain types of organisms may attain a high degree of virulence, causing rapid and extensive

fermentation and thereby changing the bacterial picture of the oral cavity from a normal low-grade flora to that of an insidious growth of micro-organisms capable of destroying the supporting structures of the teeth and the mucous barriers of the mouth and invading the deeper tissues. They may spread through the circulation to remote parts of the body.

There is a shallow space between the inner side of the gingival flap and the tooth, the gingival crevice. At the bottom of this, the mucous membrane is firmly attached to the pericementum by strong connective tissue fibers. Gingivitis occurs when masses of infectious material remain for some time in close contact with the gingivae, as when there are disturbances by impaction of food due to a lack of contact of teeth; the presence of crowns, bridges and overhanging fillings; functional inactivity; excessive occlusal stress; toothbrush abrasion; the presence of erupting teeth (particularly in the third molar region), tilted teeth (especially without approximating neighbors) and bridge abutment teeth (especially when improper clasps are used), or inadequate oral hygienic measures. Almost any mechanical irritant may cause gingivitis.

The most prevalent cause of gingivitis is the presence of calcareous deposits about the necks of the teeth.

There are two kinds of calcareous deposits, both of which are detrimental to the gums: (1) calcareous deposits arising from the saliva and (2) serumal deposits arising from the irritated soft tissues about the necks of the teeth. Salivary deposits are a combination of mucin, food particles and the minerals of saliva. They are hard yellowish limelike deposits that form about the necks of the teeth at the gum line. The sharp edges of tartar break and irritate the soft gum tissue, causing it to bleed. The irritated bleeding tissues then lay down a different deposit, called serumal calculus, which is even more brittle and more devastating than salivary calculus.

The foregoing etiologic factors are purely local conditions. The systemic factors are not so readily defined. Clinical observation and scientific advances have convinced us that metabolic disturbances, deficiency diseases, pregnancy, menstruation and certain systemic disturbances are involved in the etiology of gingivitis. However, I am convinced that the number of cases having a systemic origin is negligible, and as soon as our efforts are directed to the local causes and the elimination of them, the greater will be the success in treatment. Many who believe in the constitutional origin of gingival diseases admit that local measures, if thoroughly performed, are largely effective in checking the disease.

DIAGNOSIS

The early recognition of gingivitis and its prompt correction are of paramount importance. Normally, the gum is firm pink tissue covering the bony structure that holds the teeth in place. It is very dense and fibrous and is richly supplied with blood. At the base of each tooth, the gums form a free overlapping tissue about 2 mm. thick. Signs of chronic gingivitis are a deviation from light pink to red, indicating hypertrophy of gum tissue, or recession.

The diagnosis of gingival infection is arrived at by considering the color of the gum tissue and the tendency to bleed, and making a study of (1) the alveolar margins by transillumination, (2) bacterial smears from the gingival crevices and (3) abnormal occlusal stresses.

When a patient complains of joint pains, the history may reveal a definite sequence of acute focal infection, such as gingivitis in the acute or chronic state followed by articular manifestations.

As the streptococcus is a potent source of many diseases, so, in chronic infectious

arthritis, the presence of this organism in cultures secured from the gingival crevices should be evidence of some weight, at least, that a definite and dangerous focus has been located.

This focus of infection of chronic gingivitis should be eliminated as soon as possible. The removal of the focus itself should be considered a major procedure as far as attention to the immediate care of the patient is concerned.

SYSTEMIC PHASE

Chronic infectious arthritis presents a definite clinical problem of concern to the physician. Diagnosis of oral symptoms and the evaluation of oral diseases in terms of chronic systemic infection often tax his judgment and imagination. Focal infection from the apices of the roots has been recognized for many years as related to arthritis, and, in the last decade, has been proved a common and important etiologic factor therein. It is my opinion that we are overlooking a serious infection; namely, incipient and chronic gingivitis. The principal reason that this focus of infection has been missed is, I believe, the fact that too much stress has been placed on x-ray diagnosis, which, alone, especially where gingivitis exists, is futile. Because there has been no destruction of bony structure, these cases have been pronounced free from disease. Therefore, from the standpoint of focal infection in the mouth, I consider gingival infection more important as an etiologic factor in infectious arthritis than periapical disease. The richness of the bacterial flora under the gingival crevices, with large areas of inflammation (having more blood vessels directly in contact with the infection), facilitates entrance of the bacteria into the circulation in sufficient numbers to produce infection.

Arthritis has been classified in many different ways, and the terminology is confusing because of the multiplicity of synonyms. In general, two great groups are recognized: first, the osteo-arthritic (hypertrophic), a senescent, degenerative process which affects the bones and cartilage; second, the one we are especially interested in, rheumatoid arthritis (chronic infectious arthritis), characterized in the beginning by pain and soft tissue swelling, moving from one joint to another, and later causing a definite ankylosis. The disability may be slight or crippling, and dental foci may act either as a direct or as a contributing cause of infectious arthritis.

The manner in which infectious arthritis is produced by a focus of infection is not definitely agreed on by investigators. Some investigators who have succeeded in recovering streptococci from the blood and joints believe rheumatoid arthritis to be infectious; others believe it to be an allergic condition due to the hypersensitivity of the joint tissue to persistent localized streptococcic infection in other parts of the body. Regardless of what theory one may subscribe to, it is quite obvious that only good can result from removing this infectious material about the necks of the teeth as early as possible.

There are several ways in which gingivitis can influence arthritis. Any chronic infection, no matter how slight, makes a constant drain on the body, energy being used to destroy or resist infection. This constant loss of energy interferes with the functioning of the body. It is true that we often see presumably well patients many of whom harbor infectious foci in the mouth without apparent ill-results. The immunity which these patients have acquired, however, will not last forever. Such patients are germ carriers, and any change in their physical condition, such as long-continued fatigue, acute infection and serious illness, may reduce their power to fight a chronic infection.

The relationship of a focus in the oral

cavity to systemic disease has been clinically proved in a great number of cases, which, through the removal of the focus, have not only been relieved but have also remained cured for years. The physician, therefore, has no excuse for disregarding the fact that gingival infection is a potential source of ill-health.

TREATMENT

We cannot stress too emphatically that the treatment of gingivitis does not mean the mere rinsing of the mouth, or the topical application of medicine to the gum tissue, or the so-called "cleaning" of the teeth. It consists of the careful removal of excess cement in setting inlays and crowns, removal of poorly fitting shell crowns, relieving abnormal stresses, prevention of food impaction by proper contour for restorations, a proper method of using the toothbrush, specific instruction in home care of the mouth and periodic prophylaxis.

As a rule, all cases of gingivitis caused by local traumatic or infective stress can be promptly arrested and the tissue returned to health by the thorough application of the principles of oral hygiene; that is, when by complete removal of chronic irritants and by increase of the circulation, the gingival tissues are relieved of continuous or intermittent injury, the circulation is reestablished. Inflammation ceases and the tissues return to a normal condition. Therefore, in all types of gingivitis, the greatest benefit both preventive and curative is established by adequate hygienic measures.

There are new theories coming up all the time. We hear and read constantly about how to cure bleeding gums, and, in the meantime, there are workers in this particular field who are consistently doing excellent work in eradicating oral sepsis by means of thorough subgingival therapy and curettement, removing all irritants and relieving stresses to establish permanent mouth cleanliness. So beneficial are the results obtained by men who have become proficient in this form of treatment that these measures are accepted as effective in the control of many forms of gingivitis.

Obviously, frank oral sepsis should be effectively treated. Nothing but good can be achieved by cleaning up a septic mouth, and many cases have come under my notice in which the subsequent improvement in the physical health and the later alteration in the patient's mental attitude have been remarkable.

CONCLUSION AND SUMMARY

1. There has been established a definite relation between infectious arthritis and gingival foci of infection that may be considered primary in a fair percentage of cases.

2. A cure of infectious chronic arthritis is unlikely as long as the primary focus continues to pour into the lymphatics and into the blood stream pathologic bacteria.

3. Gingival foci are frequently a source of infection, and closer cooperation should be promoted between the physician and the dentist for the detection of these areas and their elimination as a menace to health. Only when the physician and dentist come together on a common ground will the patient receive proper care.

4. There are three factors in the control of focal infection: (1) the degree of immunity possessed by the patient; (2) the natural resistance, based on the systemic condition, and (3) the virulence of the infection. In connection with the last, surface exposure may play a large part.

5. Although the x-rays are the best single diagnostic agent that we have, and they should be used freely in cases of gingival infection, they have little value, because there may be septic areas in all the interdental spaces and yet the x-ray

films be negative. For this reason, we cannot stress too emphatically the need for more thorough clinical examination. We must not depend entirely on the x-ray diagnosis when looking for a focus of infection.

6. Although it seems reasonable that thorough removal of septic material from the necks of the teeth should improve the health of the patient, it is not to be taken for granted that these findings are considered scientific proof of actual health improvement. The evidence has merely been submitted as it was found. However, it might be added that empiric medicine has always been far in advance of scientific medicine.

BIBLIOGRAPHY

ALEXANDER, A.: That Specialty of Medicine Called Dentistry. *D. Items Int.*, 53:676, September 1931.

ALEXANDER, W. G.: Relation of Focal Infection to Systemic Disease. J.A.D.A., 10: 768, August 1923.

BADANES, B. B.: Arthritis and Dental Diseases. *D. Cosmos*, 73:1199, December 1931.

GLOVER, ALISON: Chronic Arthritis in Adults. *D. Mag.*, 45:497, August 1928.

COLYER, STANLEY: Rheumatism, Infected Jaw and Dental Surgeon. *Am. D. Surgeon*, 48:205, April 1928.

ERVIN, G. E.: Some Clinical Manifestations of Oral Foci of Infection. J.A.D.A., 16:68, January 1929.

HADEN, R. L.: Dental Infection and Systemic Disease. *D. Items Int.*, 47:242, April 1925.

Idem: Experimental Evidence of Relation of Dental Infection to Systemic Disease. *D. Cosmos*, 67:439, May 1925.

Idem: Survey of Systemic Disturbances Traceable to Infected Teeth. J.A.D.A., 17: 2015, November 1930.

HENCH, P. S.: Treatment of Dental Foci in Chronic Rheumatic Disease. *D. Survey*, 6:19, June 1930.

Hospital for Joint Diseases. *D. Digest*, 30: 40, January 1924.

KUHNS, J. G.: Chronic Arthritis in Relation to Dentistry. *D. Cosmos*, 77:888, September 1935.

GALLAND, W. I.: Focal Infection from Orthopedic Point of View. *D. Cosmos*, 77:894, September 1935.

Reaping the Whirlwind. Editorial, *D. Cosmos*, 77:901, September 1935.

LEWIN, PHILIP: Relation of Arthritis to Dental Infection. J.A.D.A., 19:2140, December 1932.

MENSOR, M. C.: Arthritis and Focal Infection of Oral Cavity. *Pac. D. Gaz.*, 36:620, October 1928.

MURPHY, F. G.: Some Rheumatic Conditions and Their Relationship to Dental Affections. *Illinois D. J.*, 4:293, August 1935.

PALMER, B. B., and CARR, M. W.: Medico-Dental Case Records: Clinico-Pathological Study of Polyarthritis and Carditis Secondary to Oral Focal Infection. *J. D. Res.*, 9: 89, April 1929.

POLLIA, J. A.: Newer Concepts of Focal Infection. *J. D. Res.*, 11:83, February 1931.

POST, W. E.: Oral Infection in Relation to Systemic Disease: Recent Studies (Viewpoint of Internist). J.A.D.A., 21:623, April 1934.

STAFNE, E. C.: Dental Conditions Found in Duodenal Ulcer and Arthritis. *D. Cosmos*, 71:404, April 1929.

ZEMSKY, J. L.: Oral Foci of Infection. *D. Outlook*, 17:303, July 1930.

HADEN, R. L.: Dental Infection and Systemic Disease. Philadelphia: Lea & Febiger, 1936.

MARGOLIS, H. M.: Conquering Arthritis. New York: Macmillan Co., 1932.

BOX, H. K.: Necrotic Gingivitis. Toronto: University of Toronto Press, 1930.

THOMA, K. H.: Oral Diagnosis and Treatment Planning. Philadelphia: W. B. Saunders Co., 1936.

BUNTING, R. W.: Oral Hygiene and Treatment of Parodontal Diseases. Philadelphia: Lea & Febiger, 1936.

STILLMAN, P. R., and MCCALL, J. O.: Textbook of Clinical Periodontia. New York: Macmillan Co., 1927.

SIMPSON, C. O.: Advanced Radiodontic Interpretation. J.A.D.A., 17:256, February 1932.

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A CONSERVATIVE SURGICAL TECHNIC FOR THE ERADICATION OF A PYORRHEA POCKET

By Lillian Barkann, D.D.S., New York City

At present, there are two accepted, though widely divergent, technics for the eradication of pyorrhea pockets. The conservative method, the one more generally employed, consists of subgingival curettage of the denuded root surfaces and grinding of the teeth to overcome traumatic occlusion. The beneficial effects of subgingival curettage, to my mind, are derived from the removal of irritants, the stimulation of the soft tissues and the disgorgement of the blood vessels by delicate instrumentation. However, although subgingival curettement of the root surfaces is adequate in the treatment of gingivitis, it is not sufficient in the presence of granulation or hypertrophic tissue.

Periodontoclasia, or pyorrhea, the result of injury, irritation (Fig. 1) or systemic disorder, or combinations thereof, presents a change from the normal structure which surrounds the teeth. The gingiva which is attached to the enamel or cementum recedes and the gingival epithelium proliferates apically. This tissue, which started as a defense mechanism in an inflammatory process, tends to ulcerate (Fig. 2), and this precludes restoration of the original normal gingival condition, even after the cause has been removed. A common cause of failure in the treatment of advanced periodontoclasia is the retention of such products of irritation and inflammation within the pocket. Equally important is the fact that infected granulation tissue is allowed to remain within an apparently closed pocket. It is this lack of thoroughness in the removal of abnormal tissue which has led to the discouraging and untrue, but often heard aphorism: "You can stop the pus temporarily, but you can't close the pocket. Eventually, pyorrhea always recurs, and the teeth must be extracted."

Less generally employed by the dentist is gingivectomy, the radical surgical procedure for the treatment of advanced cases, which requires an injected anesthetic and involves the actual removal of considerable gingival tissue and curettement of bone. Since about one-fourth or one-half of the mouth is operated on during one visit, with the alveolar process exposed and the interproximal bone cut down to the base of the pocket, a large wound results, which interferes with the normal functions of the mouth and causes considerable discomfort to the patient throughout the entire period of healing, during which the wound is covered by surgical cement. The sole advantage of this operation is that it removes the undesired granulation tissue. But this is done at the expense of much normal tissue, as well as tissue which, if permitted to do so, might have returned to normal. Furthermore, unless this operation is very skilfully performed, it may result in formation of scar tissue and exposure of the root surfaces, if not in actual mutilation.

I have devised a conservative surgical method for the treatment of pyorrhea pockets the purpose of which is the com-

plete removal of the proliferated epithelium and granulation tissue, so that contact between the root and the gingiva, in their normal relationship, may be reestablished.

In this procedure, the pocket contents are evacuated, yet a maximum amount of tissue is conserved. The interproximal gingiva is more frequently the seat of infection than is the buccal, lingual or labial, and there is no need to resect healthy tissue merely because of its proximity to infected tissue. Sutures and surgical cements are unnecessary, for the

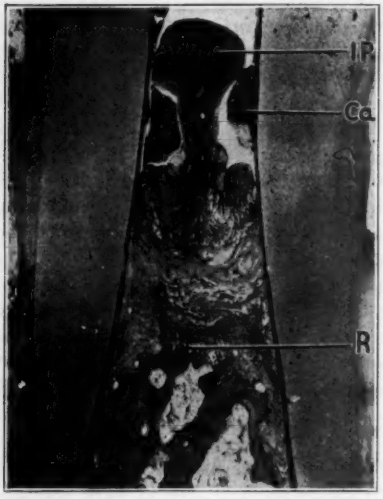

Fig. 1.—Subgingival calculus in space between two incisors; marked swelling and hypertrophy of interdental papilla; inflammatory resorption of crest of interdental bone septum. IP, interdental papilla. Ca, calculus. R, bone resorption. (From Kronfeld's "Histopathology of the Teeth.")

gingiva serves as a natural support for the blood clot.

It is my opinion that the alveolar process should not be cut. According to Kronfeld, the belief that "necrotic bone" is present in pyorrhea is distinctly erroneous and its presence has never been demonstrated under inflamed gingivae or under pyorrhea pockets. Elimination of the inflammation stops the process of bone degeneration.[1] Moreover, cutting this bone causes severe after-pain, and too frequently invites osteomyelitis. As this new technic does not necessitate resection of the buccal gingiva, nor the cutting down of the alveolar process, the root remains better protected than after radical surgical measures.

Only two or three septal areas are operated on during each half-hour visit. Such small areas are easy to control, and heal readily, the patient experiencing neither discomfort nor after-pain.

PROCEDURE

In unhygienic mouths, a prophylactic treatment is administered, and the patient is advised to use a mouth wash (formula appended) at frequent intervals before returning for treatment of the gingivae.

At the first sitting, a sedative will help overcome nervousness and apprehension. On subsequent visits, this will be unnecessary.

Satisfactory anesthesia means the difference between a painful and a painless operation. Prolonged anesthesia permits the patient to pass through the postoperative period without discomfort. However, anticipation of a hypodermic injection at each visit frequently causes a psychic disturbance which, in turn, breeds an aversion for the dentist. Furthermore, an injected anesthetic contains a vasoconstrictor, such as epinephrine or ephedrine, in order to prolong anesthesia. The presence of such drugs may destroy the important phagocytic function of the leukocytes, constriction of the capillary walls preventing free extravasation to the areas where they are most needed. Therefore, a topical anesthetic is preferable in such operations as this, which do not require deep penetration. In about seven years' experience with nupercaine,[2] ap-

plied topically, using it for prophylactic treatments or for surgical work on each patient every day, I have encountered no unsatisfactory results, such as discomfort, irritation or sloughing of the tissue. A 2 per cent solution applied topically is apparently neither a vasoconstrictor nor a vasodilator. Nor is it irritating to the hands of the operator.

By means of cotton swabs, we apply about 20 drops of 2 per cent nupercaine, to which has just been added 2 drops of saturated solution of sodium bicarbonate. Anesthesia may be expected within eight or ten minutes, time which may be well spent in preparing for the operation. In the management of advanced cases, each interproximal pocket is carefully studied and compared with roentgenograms. The least involved pockets are treated first in order to give the operator an opportunity to study the bleeding characteristics of the patient and to determine the healing power of the tissue, and to afford the patient an opportunity to build up a tolerance to the treatment. Sometimes, an interproximal space has a mesial or distal pocket, or two distinct pockets and a

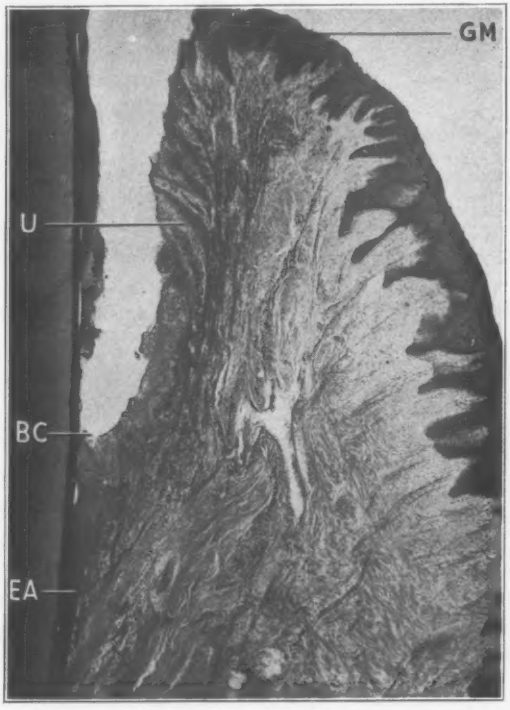

Fig. 2.—Ulceration and necrosis of crevice epithelium; lingual surface of upper bicuspid. Through the breaks in the epithelium, leukocytes migrate from the subepithelial tissues into the crevice (pus formation). GM, gingival margin. BC, bottom of gingival crevice. U, ulcerated wall of pocket. EA, epithelial attachment to cementum. (From Kronfeld's "Histopathology of the Teeth.")

firm papilla, or a single pocket which, when traced, may extend to an adjoining tooth. The case at hand and the location determine whether the entire septal gingiva is to be excised or whether each pocket should be treated individually. During subsequent visits, the few minutes while the anesthetic is penetrating are utilized for massage and stimulation of

Fig. 3.—Introduction into pocket of strand impregnated with phenol and camphor. On removal of the strand, which remains for an instant, the pocket is thoroughly curetted.

Fig. 4.—Excision of papilla and pocket lining. The cotton pellet in the pocket offers resistance to the blade. Wire ligatures immobilize the teeth. The sharpness of the knife and the speed of the camera permitted completion of the picture before bleeding began.

previously treated areas. The anesthetized tissue will usually remain numb for more than an hour, after which it will slowly return to normal. If indicated, more anesthetic may be applied, as a 2 per cent solution of nupercaine applied topically in such small quantities is quite harmless.

An antiseptic whose potency has been established is next swabbed on the gums. The following drugs have been proved useful: merthiolate (stainless 1:1000)

Fig. 5.—Excision of interproximal tissue in molar area; semilunar incision with inward bevel, using curved blade.

Fig. 6.—Excising pocket lining, buccal aspect, using straight blade.

and metaphen (untinted 1:200), each being basically a solution of mercury in organic combination, or 20 per cent argyrol.

To prepare for curetting, the pocket is packed with a strand (Fig. 3), impreg-

nated with a mixture of 25 per cent phenol and 75 per cent camphor. In this percentage, phenol acts as a bactericide, coagulates the pocket lining without causing a deep eschar and promotes normal granulation. The camphor is analgesic. If indicated, equal parts of phenol and camphor may be used with discretion.

Fig. 7.—Gauze dressing bearing coagulen being packed into bleeding pocket. The dressing is allowed to remain for twenty-four hours.

is begun. The process of packing the strands and curetting is repeated, the opening being thus enlarged and as much coagulated tissue and pocket-contents as possible removed.

With a curved knife which is designed

Fig. 8.—Appearance of case after removal of gauze packing. The tissue was pressed toward the tooth. The pocket was on the distal surface of the upper first bicuspid. There being no pocket on the mesial surface of the second bicuspid, it was not necessary to sacrifice the papilla.

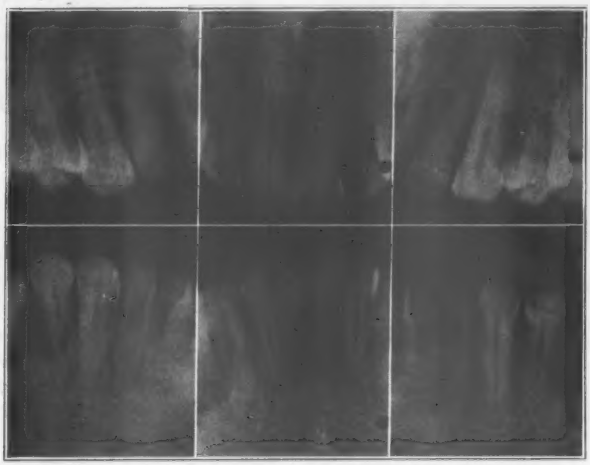

Fig. 9.—Case first seen August 1936. The patient had extracted the upper right lateral incisor with her fingers before she presented herself for treatment of the gingivae. (Compare Figure 10.)

The strand remains in the pocket for an instant and, on its removal, curetting for this purpose, and which is always sharpened before using, the papilla is

excised with a semilunar incision and an inward bevel. (Fig. 4.) With the sharp blade, the tissue walls within the pocket are scraped, fresh bleeding surfaces remaining. Special care and delicacy must be here exercised to retain the buccal and lingual walls of the pocket, as they are the supporting tissues and matrices upon which the new growth will form. They are also important structurally in forming a trough for the retention of the blood clot, through which regeneration of connective tissue proceeds.

Fig. 10.—Case shown in Figure 9; photograph taken April 1937. The central incisors and remaining lateral incisor are to be noted.

Fig. 11.—Results of conservative treatment. Although there was no noticeable pus, a loose hanging papilla, of low tonicity, was discovered between the right central and lateral incisors. The gingiva of the left central and lateral incisors had become hard and malformed. The patient had received no instruction in oral hygiene. At this stage, he was referred for treatment of the upper anterior teeth only. The lining of the papilla between the upper right central and lateral incisors was excised and its bleeding surface was packed tightly against the exposed interdental alveolar process. The lining of the labial gingiva of the left central incisor was then excised and oral hygiene was instituted. (Compare Figure 12.)

A buccal or lingual marginal crevice of a tooth that is deeper than normal is treated like an interproximal pocket, except that a straight blade is used for excising the epithelial lining. (Figs. 5 and 6.)

After all extraneous matter has been removed, and when the inner wall is bleeding freely, the pocket is packed tightly with quarter inch gauze dressing, about 1½ to 2 inches long, which has been moistened with sterile water, and into which coagulen has been incorporated. (Fig. 7.) It is rarely necessary to pack a broad, shallow marginal pocket.

Fig. 12.—Case shown in Figure 11; six weeks later.

The tissue is pressed firmly to encourage attachment. Pain, if present, can be assuaged by application of a paste composed of acetyl salicylate[3] and any commercial mouthwash, placed on the treated area and permitted to remain for about five minutes. It is advisable not to tell the patient that this remedy is made with commercial aspirin as such informa-

tion may lead to dangerous self-medication. Acetyl salicylate may remain upon the gums for ten minutes without harm, but on remaining for a longer period, it is apt to cause injury.

The following day, the gauze dressing is removed (Fig. 8), and the area irrigated with a normal saline solution and swabbed with an antiseptic. If very deep, the pocket is packed for another day with gauze saturated with an antiseptic, such as metaphen or merthiolate.

Interdental stimulation is started as soon as the condition permits, and the patient is taught the importance of raising the resistance by systematic brush massage and the use of various stimulators.

In this procedure, no mention has been made of grinding the occlusal surfaces. Only in rare, isolated cases is a tooth ground before treatment. As the removal of hypertrophic tissue from the pocket causes a change in the relationship of the teeth to each other, loose drifting teeth should be ligated to stronger ones. This protects the new forming tissue from injury by malocclusion, and assures the same result as disocclusion by grinding. When the ligatures are removed, on completion of the case, the time is propitious for testing the occlusion to determine whether grinding is necessary. If it is found that the gingival tissue is regenerated, the pocket obliterated and the tooth firm in its socket, there can be no reason for changing the occlusion.

When tempted to grind teeth, it is well to remember that Stillman and McCall, originators of the term "traumatic occlusion," found that abnormal stress does not necessarily result in injury. When one or more teeth are subjected to unusual strain, the supporting structure will either become reinforced, and the teeth be enabled to withstand the increased functional demand, or it will break down under the strain[4]; so nothing has been lost by postponing grinding of the occlusal surfaces while the teeth are supported by metal ligatures. One might also bear in mind, when considering grinding, that a ground tooth has a tendency to erupt further, thus returning to malocclusion, and exposing more of the root, whereas the original object of disoccluding a tooth—relief from strain—can as well be accomplished by ligating.

In this technic, as in all others, the cooperation of the patient is essential. Unless the tone of the gingivae can be maintained at a high standard, there is always danger of recurrence. It has been my experience that patients become accustomed to vigorous brushing during the series of treatments and usually maintain this high standard of gingival tone.

SUMMARY

The conservative surgical technic here introduced combines the advantages of both the conservative and the radical, with complete elimination of the infected granulation tissue within the pockets and a maximum conservation of the gingivae.

1. The application of an anesthetic, preferably topical, in the treatment of the gingivae enables the operator to complete the task with greater thoroughness and with the comfort of the patient assured.

2. A combination of phenol 25 per cent and camphor 75 per cent is used to disinfect and cauterize granulation tissue before and after excision.

3. The use of cotton strands facilitates the application of caustic drugs.

4. The occlusal surfaces are not ground before or during operation. If the prognosis was good, with intended change of occlusion, the results of the treatment almost invariably preclude grinding.

5. Ligation of mobile to immobile teeth with metal ligatures permits uninterrupted regeneration of supporting tissues.

FORMULAE AND OPERATIVE AIDS

Topical Anesthetic

20 drops of 2 per cent solution of nupercaine
2 drops saturated solution sodium bicarbonate
Combine only when ready to use.

Mouthwash

To a glass of lukewarm water, add:
½ teaspoonful salt
½ teaspoonful borax
1 tablespoonful hydrogen peroxide
Make fresh each time.

Cotton Strands

In the application of camphor and phenol, or other caustic drugs, cotton strands are preferable to pellets. When cotton is compressed by pliers, the excess fluid flows between the prongs, where it may be unnoticed, and can cause an unexpected burn. An added advantage of strands is that they may be prepared in advance, in quantities, and stored without fear of disintegration.

Five-ply cotton twine, plain or polished, is boiled in soap suds to remove the dressing, rinsed, sterilized and dried thoroughly between towels. It is then cut into one-inch lengths and separated into single-ply, then stored in wide-neck stoppered bottles.

Phenolated Strands

25% phenol
75% camphor

Pour the solution into a wide-necked bottle containing cotton strands, drain off all excess and add more strands to absorb all possible moisture.

Ligatures

Angle's ligature wire No. 187 coarse
Angle's ligature wire No. 186A medium

Instruments

Bates' spiral spoon curettes—ivory
Barkann knives—curved, 1-2
straight, 3-4—ivory

Interdental Stimulators

Toothbrush
Stim-u-dents
Rubber interdental points
Pipe cleaners

Pipe cleaners are cut into thirds and the tips protected with wisps of cotton and sterilized with dry heat. They are used where space permits.

BIBLIOGRAPHY

1. Kronfeld, Rudolf: Diseases of Periodontal Tissues. Philadelphia: Lea & Febiger, 1933, pp. 299-300.

2. Barkann, Lillian: Nupercaine in Periodontia. *D. Cosmos*, 75:580-582, June 1933.

3. Barkann, Lillian: New Painless Treatment in Periodontal Disease. *D. Cosmos*, 73: 674-677, July 1931.

4. Stillman, P. R., and McCall, J. O.: Clinical Periodontia. New York: Macmillan Co., 1937, p. 63.

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AT WHAT AGE SHOULD ORTHODONTIC TREATMENT BEGIN?

By Francis W. Nash, D.D.S., Scranton, Pa.

At what age should orthodontic treatment begin? This is a perennial question in the orthodontic world, and since in its complete comprehension it cannot be succinctly answered, it will probably remain unsettled for some time to come, at least in some of its phases. The reason for broaching it here may, however, be stated briefly. It is the continually encountered dictum that the time for treatment has arrived when all the permanent teeth are erupted. This is not only a serious fallacy, but is also one of the most thoughtless statements made in dentistry. It probably had its origin in the failure to find the permanent arch and teeth evolving in normal occlusion after developing the deciduous denture to the Bogue normal or after establishing, with appliances, the developmental spaces in the deciduous denture.

Another factor in all probability has been the long time treatment, or at least the maintenance of appliances in the mouths of children from the time there is an irregularity in the deciduous teeth until the eruption of all teeth except the third molars, and then the discovery, at the age of 15 or 16, that the alinement obtained is not being maintained by Nature.

Again, there have been those cases of which it is said that the irregularities corrected themselves. This is simply due to the fact that, in all probability, no real malocclusion existed in the developing denture, but it was rather a stage of transition, a stage of development or growth. The teeth appeared jumbled, but in truth such a condition was proper for that particular stage of development. In this connection, it might be stated that one of the most important marks of an orthodontist is his ability to determine whether he is looking at a stage of development or a developing malocclusion.

Whatever may have been the cause for this still-existing belief that correction should begin when all permanent teeth are erupted, the fact remains that it is erroneous and is a harmful and expensive doctrine.

There is also another mistaken notion, in my experience at least extraordinarily common, that nothing can be done for the adult patient. Since among those limiting their practice to orthodontia, and who are well grounded in it, these beliefs are not held, it appears that the true state of things should be revealed to the general dentist, since he is chiefly responsible for the propagation of these erroneous views.

In considering particular cases to illustrate the conditions mentioned, the Angle or Lischer classification of dental anomalies of position will be used.

ANGLE CLASS I OR NEUTROCLUSION (LISCHER) CASES

The treatment of irregularity or rotation of teeth of the deciduous denture is

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not warranted as a general rule. Many times, we find the lower permanent central incisors erupting in a marked lingual position, the deciduous central incisors remaining in place. If the deciduous central incisors do not naturally exfoliate when the crowns of the permanent teeth are about one-third erupted, the extraction of the deciduous central incisors is indicated, after which, as a general rule, a space retainer should be applied. This statement is made in the face of contrary views expressed by such an authority as Hellman. There is no question that a multitude of cases exist in which the permanent denture, despite the fact that the deciduous teeth have been lost long before their normal exfoliation time, has evolved correctly, though functionless in some areas and with no stabilizing artificial aid. But too many cases have not responded in this way and therein is evidence that there is no certainty on this point. We can be more certain if the spaces are maintained and this is the simple reason for space maintenance. Al-

Fig. 1.—Models showing improvement in position of lingually erupting lower incisor teeth without any appliance therapy.

Fig. 2.—Shifting of permanent teeth due to loss of deciduous teeth. The use of space maintainers would have improved the condition.

Fig. 3.—Class II and Class III cases in deciduous denture requiring short period to place in position for normal development.

the permanent central incisors will move into the arch from the natural pressure of the tongue. This is also true of lateral incisors. (Fig. 1.)

If the deciduous teeth are lost prematurely, from whatever cause, in my belief

though we are not here dealing with technic, it is proper to say that the devices used should not hamper normal growth.

ANGLE CLASS II OR DISTOCLUSION (LISCHER) CASES

In Class II, Division 1 cases, if presented

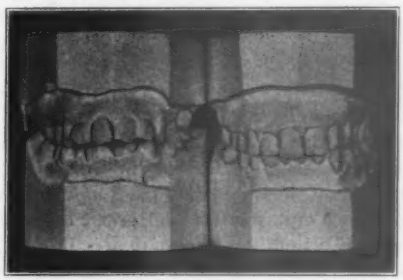

Fig. 4.—Anterior view prior to and after treatment of case. The patient was 25 years old when treatment was initiated.

eliminating any habit causing the malocclusion and establishing normal mesiodistal relationships of the arches.

With regard to habits, this means elimination of thumb or finger sucking, tongue habits and mouth breathing. The last must necessarily include elimination of the cause of the mouth breathing.

If any of these habits have caused the malocclusion and they are controlled or eliminated, a few months' use of appliance therapy will be sufficient to correct the condition. This does not insure, of course, that the permanent denture will develop normally, but the great advantage in such a procedure is the establishment of normal mesiodistal relations with the concomitant normal development of musculature and facial form. This eliminates a sometimes distressingly long retention period, when these cases are not corrected until later years. Even if no appliance therapy is utilized, habits

Fig. 5.—Occlusal views of case shown in Figure 4.

Fig. 6.—Occlusal views of case in which patient was 32 years old when treatment was started.

at from 3 to 5 years of age, x-ray examination indicating that resorption of the deciduous teeth is not at all advanced, the deciduous denture should be treated to the extent of correcting the protrusion, which are definitely producing deformities should be corrected.

In Class II, Division 1 cases, after 5 years of age, years in which the transition of the denture is very marked, re-

sorption going on quite rapidly, it is not wise to utilize appliance therapy until approximately 7 years of age. This is because it is impossible to affect the premaxillary area properly and treatment might hasten resorption of the anterior deciduous teeth. Meantime, elimination of habits producing the condition is the principal remedy.

Appliance therapy at 7 years or after eruption of the central incisors and first permanent molars should be carried on only to the establishment of normal mesiodistal relations. Continued use of appliances to induce alinement throughout the arch is not warranted. This can be better done when the permanent teeth are in the arch.

In giving the chronologic ages in the foregoing paragraphs, it is not the intention to construe them too literally; in other words, each case must be judged on its own merit. There might be a very great development of the permanent dentition at $4\frac{1}{2}$ years of age, with concomitant resorption of the roots of the deciduous teeth, in one case, and, in another case, this might not occur until $5\frac{1}{2}$ years of age.

Class II, Division 2 cases are another matter. Appliance therapy for these cases in the deciduous teeth has not been successful in my hands. Successful results have been obtained, however, in treatment at about 7 years of age. This means appliance therapy is used only until the establishment of normal mesiodistal relations.

In Class III cases, or mesioclusion, early treatment is indicated; that is, treatment of the deciduous denture. This type, like the Class II, Division 1, will respond very rapidly at 3 or 4 years of age. Naturally, when these patients report for treatment with further advanced cases, we have no alternative except to treat them if it is feasible. (Fig. 3.)

Cases at 7 years of age or thereabout, presenting pseudo-Class III irregularity, that is, the upper incisors in linguoversion to the lower, should certainly be treated.

The last group to be considered are the adult cases. Two cases are shown, one at 25 years and one at 32 years when treatment was begun. It is not my contention that all irregularities which present themselves at these ages or in this age range are amenable to orthodontic treatment, but there are cases at this age in which treatment is warranted because of the benefits to the patient. This, of course, is the yardstick that should be used in all these cases. How much good will it be to the patient? In both of the cases presented (Figs. 4, 5 and 6), the upper jaw protrudes and naturally the correction will eliminate a considerable degree of facial deformity.

Roentgenograms and other data concerning the cases shown have been purposely omitted and are mentioned only to record that they are important data. Although no mention has been made of muscle therapy, it may be stated that this was used and with great advantage. The following conclusions are believed warranted:

1. Waiting until the permanent teeth are in before beginning treatment with appliances to correct malocclusion is unsound and erroneous.

2. Many cases of malocclusion in adults can be treated with immense advantage to the patient.

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DENTAL ATTRITION

By MEYER KLATSKY, D.D.S., New York City

DENTAL attrition is a subject that is not receiving its merited attention from the dental profession. With the exception of a recently published article dealing with changes in teeth due to attrition,[1] I have found no systematic treatises on this important subject in modern dental literature; and other historical data are both meager and confusing.

Attrition of the teeth is erroneously considered an abnormal, disease condition; and, like other lesions of the teeth, such as caries, erosion and abrasion, it is generally placed in the realm of pathology. Many authorities do not differentiate between attrition and abrasion, using the two terms interchangeably. I have found no reference to the term "attrition" in the works of G. V. Black. He[2] defines abrasion as "abnormal wear of the teeth—more wear than occurs from the normal processes of mastication." Chapin A. Harris, Louis Ottofy and Dunning and Davenport, in their dental dictionaries, give similar definitions for attrition and abrasion.

Reference to works of other authorities, however, reveals that a definite line of demarcation is drawn between attrition and abrasion, distinguishing one from the other. Thus, in his Dictionary of Dental Science, L. Pierce Anthony defines "attrition of the enamel" as the "gradual wearing away of the enamel through the physical and physiological agencies of mastication of food." The same author defines abrasion as "a term applied to the rapid wasting and destruction of enamel and dentin by friction set up by foreign bodies."

In differentiating the two terms, Marshall[3] says: "Attrition, applied to the teeth, is the wearing away of the tooth substance, caused by the friction of mastication. Abrasion, in dentistry, the wearing away of the enamel and dentin upon the morsal surfaces by mechanical means, or a loss of substance through friction of a foreign body."

Colyer[4] says: "Attrition is a wearing away of the tooth substance caused by the grinding of one tooth surface over another. The term abrasion is used to denote the destruction of the tooth-substance by friction with a foreign body, such as a denture, pipe, tooth-brush or tooth-powder."[5]

From these definitions, we can readily see that the terms abrasion and attrition are not synonymous, but are two different terms denoting dissimilar conditions. Attrition is a general condition usually affecting the morsal surfaces of all the teeth in the mouth; abrasion is a local condition, only those teeth or surfaces with which the foreign body comes in contact being affected. Attrition results from the *use* of the teeth; abrasion results from tooth *abuse*. Attrition is a natural, functional phenomenon, and therefore belongs to the domain of dental physiology. Abrasion is an unnatural, a disease condition, and is therefore to be placed in the realm of dental pathology.

THE PHYSIOLOGY OF DENTAL ATTRITION

Dental attrition is the gradual loss of tooth structure caused by the natural processes of food mastication. When food is introduced into the mouth, the dy-

namic mandible begins its movements. Actuated by the powerful muscles of mastication, it moves up and down, forward and backward, and from side to side, thus slicing and shaving, rubbing and grinding the food between the uneven surfaces of the teeth. While performing this function of changing food into a finer consistency and making it more suitable for digestion, the morsal surfaces of the teeth, in their turn, also undergo certain changes by gradually yielding some of their own substance to the friction of the food.

All living organs and tissues constantly undergo some changes while they function. There is some degeneration of old cells and regeneration of new ones taking

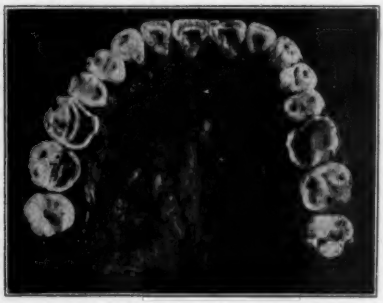

Fig. 1.—Physiologic state of dental attrition. (Figures 1-3 are illustrations of crania of aboriginal Californians preserved in the University of California Museum of Anthropology, examined by R. W. Leigh, through whose courtesy they are presented here.)

place all the time. But the enamel of the teeth, which consists almost entirely of inorganic matter, does not have the power of regeneration possessed by most other tissues in the human organism. Hence, the loss of enamel substance inevitably leaves indelible marks on the morsal surfaces of the teeth. The tips of the cusps are affected first; then the wear spreads wider and deeper, flattening down the cusps and obliterating the enamel. When the dentin is reached, Nature attempts to protect the pulp by depositing layers of secondary dentin; but, ultimately, this barrier too is overcome by the natural forces of wear, until the pulp of the tooth is exposed and destroyed.

The incontrovertible fact that excessive wear of teeth leads to pulp devitalization, and that, in its last stages, attrition may be the cause of dental disease, leads many to the mistaken belief that dental attrition *per se* is a pathologic process. This is a fallacious assumption. There are numerous instances of physiologic processes of the human body being associated with symptoms of disease. Take, for example, pregnancy, childbirth, menstruation and the menopause. These

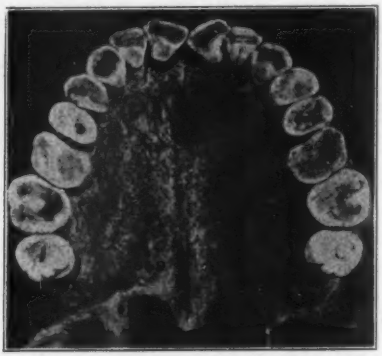

Fig. 2.—Transitory state of dental attrition.

conditions are accompanied by pain, nausea or bleeding and at times by confinement to bed. Or take the natural process of growing old, which is associated with general feebleness and a weakened systemic condition, predisposing to various diseases and ultimately leading to death. And yet all these are not pathologic, but are natural processes. Tooth attrition, which is the result of natural masticatory function, belongs to this class of physiologic phenomena.

There are many conditions contributing to and determining the degree of attrition of teeth in the human mouth.

The age is one. Since attrition is a slow process, always advancing with age, it is natural to find more tooth attrition in advanced age than in youth. The shape of the teeth and the manner of their occlusion play an important part in attrition. In cases of abnormal or traumatic occlusion, where there is a malrelation of the inclined planes of the teeth, those teeth that are in greater contact are wearing much faster than the others. However, in a normal mouth, other factors being equal, the degree of attrition is determined mainly by the amount of force exerted on the teeth during the normal process of mastication. The masticatory stress exerted by one individual

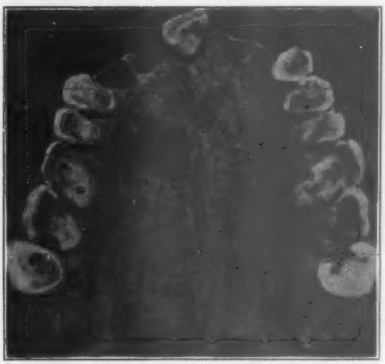

Fig. 3.—Senile state of dental attrition.

in the process of chewing differs radically from that of another, depending on the degree of development of the masticatory apparatus and on the manner in which the individual masticates his food.

The state of development of the masticatory musculature in turn depends in large measure on the physical nature of the food that is consumed. Hard, bulky fibrous food requires greater muscular play and tooth exercise in mastication than does soft, liquid or refined food. Hence, we find the masticatory apparatus of those who subsist on the latter type of food in a weaker and less developed state, the stress exerted on the teeth being much smaller than when food is of the former type. The physical nature of the food also has a direct bearing on attrition. Foods of rough and gritty consistency will cause greater attrition than soft foods. Thus, tooth attrition depends mostly on the physical and physiologic forces brought into play during the process of food mastication.

INCIDENCE OF DENTAL ATTRITION

Since food mastication plays such an important rôle in tooth attrition, greater wear of the teeth is found in ancient and prehistoric peoples than in modern, civilized races. Attrition is characteristic of the teeth of primitive man in contradistinction to the condition of the teeth of modern man, which show very little attrition. Uncivilized man, to whom the culinary art was unknown, and who was in the habit of consuming his food in its natural, raw and unrefined state, had a more efficient masticatory apparatus than modern man. His strongly developed muscles of mastication, which functioned vigorously, exerted a great amount of pressure and stress on the teeth. This great strain, combined with the rough nature of his food, caused rapid wear of the teeth. Not only was dental attrition prevalent in the adult members of these ancient races, but even young subjects show distinct marks of wear on the teeth. This can easily be observed in any museum by examining collections of the skulls of old races.

The examination of skull collections is of great importance to the dental student, as it conveys a wealth of information about the dental organs and the teeth. Anthropologists and archeologists avail themselves of the opportunities offered by collections of human skeletal remains in their quest for information concerning the life of primitive man. The scientific researcher is constantly looking for new relics that will possibly shed some

light on the complexities of the human organism. Ancient skeletal remains are constantly being unearthed in different parts of the globe and preserved for study. Very often, the discovery of a single bone of an old human skeleton proves to be of great significance.

Of all the parts of the human skeleton, those of most vital importance to the anthropologist are the ones which enter into the makeup of the masticatory apparatus, such as the jaw bones and the teeth. Many volumes have been written on the first man, and theories about man's ancestors have been based on mere fragments of jaws and some teeth. The Piltdown Man was created from a part of a skull-cap, a fraction of a mandible and two molar teeth. The Heidelberg Man was reconstructed from a single mandible retaining its teeth. The Java Ape Man was built up from a few teeth, some scattered fragments of a skull and a thigh bone.

Although the jaw bones and teeth are of much importance to the anthropologic researcher, they are of still greater significance to the dental student, who is especially interested in the masticatory apparatus and its organs. The museum with a rich collection of ancient and prehistoric crania offers a great field for research in comparative dental anatomy, physiology and pathology. Such research has occasionally been undertaken by members of our profession, notable among whom is Major Rufus Wood Leigh, Dental Corps, U.S. Army, who has contributed abundantly to dental science by his illuminating descriptions of dentitions of old races, based on examination and study of skull collections in various museums. Credit is also due Dr. Leigh for our improved knowledge of dental attrition among ancient peoples.

Another valuable source of information regarding the mouth and teeth of primitive man is the examination and study of dentitions of savage tribes living at present in uncivilized communities. We are all familiar with investigations along these lines carried on by two American dentists, Weston A. Price, of Cleveland, Ohio, and L. M. Waugh, of New York. These men have devoted a good deal of time to travelling and visiting distant lands inhabited by isolated savage tribes. Their investigations show that these primitive peoples have better developed masticatory organs and less dental disease than have civilized men. They have also demonstrated that, on contact with civilization, the teeth of these uncivilized races tend to lose their natural immunity, and fall prey to such diseases as caries and periodontoclasia.

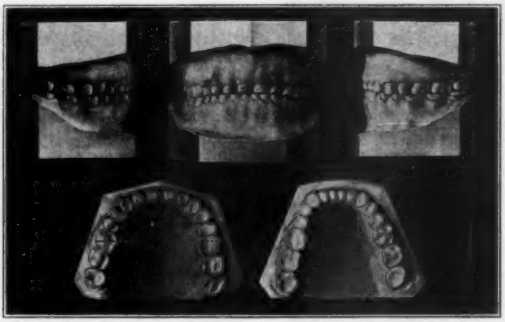

Fig. 4.—Models of dentition of young Eskimo woman, showing thirty-two well-worn teeth with no decay. (Courtesy of L. M. Waugh.)

Fig. 5.—Dentition of girl aged 20; thirty-two perfectly developed teeth in physiologic state of attrition. (Figs. 4-10 from author's files.)

Fig. 6.—Case in man aged 40; teeth well worn, but still in physiologic state of attrition.

This is generally ascribed to the adoption by those savages of our civilized food habits.

Price[6] attributes this phenomenon to the difference in chemical composition and nutritional value of the foods consumed by civilized and uncivilized peoples. Waugh, on the other hand, stresses the great difference in the physical nature of the food and the manner in which it is masticated. After a special study of the Eskimo of Alaska, he states that the fish and meat diet used by the Eskimos contributes greatly to the development of a powerful masticatory apparatus, healthy jaw bones and teeth. He has also shown that the physical and physiologic factors of hard bulky food and vigorous mastication cause great attrition of the teeth of the Eskimo. To quote Waugh[7]:

> This vigorous chewing of food is beyond question the great factor in jaw development, as the children have little other food after weaning. Newly erupted teeth have cusps, grooves and fossae as deep and well formed as those of white children; but, because of the vigorous mastication, the occlusal surfaces soon become so much worn that by 12 to 16 years of age, they are quite noticeably flattened. This is probably due in part to the presence of grit, picked up when the fresh meat and fish are laid on the ground prior to "curing." As the occlusal surfaces of the teeth become abraded, still greater muscular effort is necessary for mastication.

To test the extent of development of the masticatory apparatus of the Eskimo people, Waugh measured their biting stresses by means of the gnathodynamometer, and found, to quote again:

> Gnathodynamometer data for the molar bites of 151 natives in most primitive villages registered in pounds: males (over 14 years), 19 between 200 and 250 pounds; 34 between 250 and 300; 14 between 300 and 330; 14 over 330; highest, 348; females (over 14 years), 12 between 200 and 250; 9 between 250 and 300; 3 over 300; highest, 326.[8]

The biting stress of the average American is about 150 pounds, according to the investigations undertaken and recently reported by Arthur O. Klaffenbach.[9] Thus, we see that the biting stress of the average Eskimo is approximately twice as great as that of the average American.

Lack of development and weakness of stress of the masticatory organs of civilized man are due largely to the softness of modern food, which does not stimulate the muscles of mastication to any great activity. With little pressure on and insufficient exercise of the teeth, it is very natural to find little or no attrition in teeth of young subjects among civilized people. Lack of function also explains why the teeth of modern youth easily become the victims of diseases; so that, by the time adolescence or middle age has been reached, most of the teeth have either been destroyed by caries or, in case the teeth have been cared for by the dentist, the morsal surfaces are generally covered by fillings, inlays or crowns, and no attrition is discernible.

However, despite this general condition, the dental clinician in active practice very often sees some cases which are exceptions to the rule. Even in modern, civilized communities, there are some people who are fortunate in possessing strong and healthy teeth without caries or other disease. These conditions are more often found among people of foreign birth who were brought up under more natural conditions, and who are more in the habit of eating hard and bulky foods. More than 100 of these cases have been selected for scientific study. On investigation, it was found that all such patients are in possession of strong and well-functioning muscles of mastication and powerful jaws. Their teeth, like those of ancient and primitive races, show a great deal of attrition. We have roentgenographed these mouths, and have been watching them and fol-

Fig. 7.—Case in man aged 49; transitory state of attrition.

Fig. 8.—Case in man aged 50; transitory state of attrition. The beginning of proximal decay is evident.

lowing the course of attrition in them for many years. The present study is based mainly on the investigation of these rare and interesting cases.

THE STAGES OF DENTAL ATTRITION

Dental attrition is usually divided into four stages or degrees. Leigh[10] describes them as follows:

> First degree is that stage of wear in which the enamel of the cusps is worn without exposure of the underlying dentin; second degree is characterized by obliteration of the cusps with partial exposure of the dentin but still showing enamel at the bottom of the grooves; in third degree, the tooth has been considerably shortened, even approaching the neck, completely exposing the dentin; in fourth degree, attrition exposes the pulp.

This division is quite arbitrary and is made merely for convenience. Since attrition is a gradual and slow process, it is impossible to draw any sharp line of demarcation as to where one degree ends and another begins. When we examine a set of teeth which show attrition, we usually find that some of the teeth are worn more and others less, and it is difficult to decide to which stage it belongs. Not only are these four divisions quite arbitrary, but also any given category is susceptible of a variety of interpretations. However, what is of greatest importance to us in our study of attrition is its relation to the state of health or disease of the teeth and their surrounding tissues. Therefore, for practical purposes, we have found it imperative to divide attrition into the following three stages: (1) the physiologic; (2) the transitory, and (3) the senile.

1. *The Physiologic Stage.*—The teeth are said to be in the physiologic or functional stage of attrition when wear has not progressed beyond the enamel, the dentin remaining for the most part intact. It includes the first and second degrees of attrition as defined above. At this stage, the teeth are in their healthiest state and function best. Since dental attrition is the product of proper function of the masticatory apparatus, it is natural to find the mouth and teeth in a clean and hygienic state. There is very little tartar formation on teeth that are exercised vigorously during the natural process of food mastication. We find no food débris clinging to, and no food impacted between, the teeth. The crowns of the teeth are uncoated, and they have their natural brilliant luster. There is no better cleanser of the teeth than forceful mastication of detergent food. In our collection of dentitions with attrition, in some cases resort has never been made to artificial means, such as the toothbrush, for cleaning the teeth, and yet the mouths are in a more hygienic state than those of others who do brush their teeth scrupulously, but do not masticate their food properly.

A clean mouth and properly exercised teeth offer little encouragement to plaque formation and bacterial colonization; hence, the teeth in this state of attrition are not susceptible to caries. The same is true of periodontoclasia. When the mouth is in a hygienic condition, the gums are constantly being stimulated by mastication of proper kinds of food and there is little tartar and no food débris around the necks of the teeth, there is no cause for pyorrhea.

The physiologic stage of attrition usually prevails until the average age of 40.

2. *The Transitory Stage.*—This, as its name indicates, is a stage intermediate between the physiologic and the senile stage. It comprises the third degree of attrition as defined by Leigh, which is characterized by an appreciable loss of dentin. The teeth at this stage of attrition become sensitive to thermal and chemical changes. They easily react to cold or to sweet and sour. These chemical and thermal stimuli are transmitted to the pulp from the surface of the exposed dentin. This irritation stimulates

Fig. 9.—Case in man aged 50; senile state of dental attrition. Missing teeth were extracted because of pulp exposure from extreme wear.

Fig. 10.—Case in woman aged 60; senile state of extreme dental attrition. Some teeth were lost; others were saved by root-canal therapy.

the pulp to renewed activity, causing the formation of secondary dentin, which protects the pulp. This stage, which lasts from five to eight years, is the period in which the teeth lose their natural immunity and pass into a state of susceptibility to dental pathologic conditions.

3. *The Senile Stage.*—In this stage, classed by Leigh as the fourth degree of attrition, the teeth are quite old and worn and begin to lose their vitality, owing to pulp exposure. This stage is accompanied by various diseases of the teeth and the surrounding tissues. The most important factor in this stage is exposure of the pulp. The dental pulp can maintain its vitality only when protected by walls of dentin. Once this protection is broken through, the pulp reacts immediately to the irritation of the air, saliva, food particles and bacteria with which it comes in contact, inflammation resulting.

Inflammation of the pulp, or pulpitis, is characterized by sharp, stinging, lancinating, throbbing pain. This pain may last only a few hours; or it may keep up for a few days, the time depending on the power of the pulp to resist the foreign invasion. The pain subsides immediately after the pulp is strangulated.

A devitalized pulp does not remain dormant very long. When vitality is lost, a pulp decomposes and suppurates. The pyogenic micro-organisms and their waste products and the mephitic gases formed as a result of the decomposition of the tissues of the pulp pass through the apical foramen, and, coming in contact with the tissues of the apical space, cause irritation and a lowering of the vitality of these tissues, resulting in inflammation of the peridental membrane, or pericementitis. The first symptom noticed is a gnawing, uneasy feeling of tension in and about the tooth, with a desire to bite on the tooth. Lateral percussion of the teeth reveals slight tenderness. The gum around the tooth becomes swollen and tender, and the free margins assume a red or purple hue. Then pain of a deep, dull, constant character appears. Lateral percussion becomes painful and throbbing. This condition generally prevails for a few days; then, the acute condition changes and becomes chronic. However, the products of the decomposed pulp pursue their natural course. They invade the other tissues surrounding the apex of the tooth, periapical osteitis, abscess formation and bone necrosis resulting.

The first reaction to the excruciating pain is to avoid pressure on the aching tooth. The natural tendency is to shift the biting and chewing of food to the less painful side of the mouth when the pain is unilateral. Consequently, the painful side is neglected and is not exercised during the process of mastication. The teeth that are not being used in chewing food become neglected and remain in an unclean and unhygienic condition. When pain prevails on both sides of the mouth, the natural tendency is to lessen the stress of mastication, and to avoid solid foods. This leads to an unclean condition of the entire mouth. When in an unhygienic state, the teeth become susceptible to caries and periodontoclasia.

Another important factor in tooth decay and pyorrhea during this stage of attrition is the loss of the points of contact between the teeth. These contact points are very important to the preservation of the health of the teeth. Their loss permits food to become impacted in the interproximal spaces. This impacted food serves to protect the acid-forming micro-organisms which colonize on the proximal surfaces of the teeth. As a result, we find in such cases that caries begins on the approximal surfaces, and later spreads to the other surfaces of the teeth. The constant irritation of the gum tissue from food impaction also contributes in large measure to the causation of periodontoclasia.

The mouth presents a pitiful spectacle,

with many diseases working toward degeneration of the teeth and the entire masticatory apparatus. This is the most destructive phase of dental attrition.

SUMMARY

1. Dental attrition is not a pathologic, but rather a physiologic process, the result of normal masticatory function.

2. Function begets attrition. The two conditions are inseparable. There can be no attrition when the teeth do not function. The greater the function, the more extensive the attrition registered on the teeth. Therefore, attrition is the index of function, the yardstick by which function can be measured.

3. Dental attrition must be dissociated from dental diseases such as caries, erosion and abrasion; especially must it be distinguished from abrasion, the latter being an unnatural condition resulting from tooth abuse from friction on the teeth by foreign bodies.

4. The most important factors in tooth attrition and the amount of wear of the teeth are the physical nature of the food and the amount of stress exerted on and by the teeth during the process of mastication.

5. Dental attrition is prevalent in the teeth of savage and primitive tribes who subsist on a meat and fish diet, and it is characteristic also of the teeth of ancient and prehistoric peoples who used raw, natural foods for their sustenance.

6. There is little evidence of attrition in the teeth of modern, civilized races, owing to the softness of foods used and the lack of function of the masticatory apparatus.

7. In exceptional cases among modern peoples, where the diet consists of hard, bulky fibrous foods and a powerful, well-functioning masticatory apparatus is developed, the teeth manifest a good deal of attrition, resembling those of primitive peoples.

8. As to its relation to the health and disease of the teeth, dental attrition is divided into three stages, the physiologic or functional, when the teeth are in a clean and healthy condition and the transitory, wherein the teeth begin to lose their immunity and pass to the next, the senile state, where the teeth are badly affected by disease which leads to their degeneration and disintegration.

CONCLUSION

The study of dental attrition has shown that normal function of the masticatory apparatus is not entirely an unmixed blessing. Although properly functioning teeth are kept in a more hygienic and healthy state during the greater part of life, in more advanced age function tends to hasten the senile stage of attrition with its attendant pathologic involvements, causing much suffering and misery. On the other hand, teeth which do not function properly fall easy victims to dental caries and other degenerative diseases very early in life. The present deplorable state of the teeth of modern youth is to be attributed directly to the lack of proper function of the masticatory organs. The greatest problem confronting the dental profession at the present moment is not how to combat dental attrition, but, on the contrary, how to promote functional activity of the masticatory apparatus, which is the greatest factor in the preservation of a healthy mouth and good teeth.

BIBLIOGRAPHY

1. Van Huysen, Grant; Hodge, H. C., and Warren, S. L.: Quantitative Roentgeno-Densitometric Study of Changes in Teeth Due to Attrition. *J. D. Res.*, 16:243, June 1937.

2. Black, G. V.: Operative Dentistry. Vol. I. Ed. 7. Chicago: Medico-Dental Publishing Co., 1936, p. 316.

3. Marshall, J. S.: Operative Dentistry. Ed. 3. Philadelphia: J. B. Lippincott Co., p. 387.

4. Colyer, J. F.: Dental Surgery and

Pathology. Ed. 4. London: Longmans, Green and Co., 1919, p. 426.

5. *Ibidem*, p. 417.

6. PRICE, W. A.: Eskimo and Indian Field Studies in Alaska and Canada. J.A.D.A., 23: 417, March 1936.

7. WAUGH, L. M.: Influence of Diet on Jaws and Face of American Eskimo. J.A.D.A., 24:1644, October 1937.

8. *Idem:* Dental Observations Among Eskimo. *J. D. Res.*, 16:356, August 1937.

9. KLAFFENBACH, A. O.: Gnathodynamics. J.A.D.A., 23:371, March 1936.

10. LEIGH, R. W.: Dental Pathology of Aboriginal California. Berkeley: University of California Press, 1928, p. 408.

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DENTAL PAIN OF ANTRAL ORIGIN

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TENDERNESS and pain in the teeth and gums are not always the result of pathologic conditions amenable to dental treatment. The dissatisfaction of many patients, unnecessary extractions and the construction of unwearable plates and painful partial dentures are the fault of the dentist who fails to recognize the fact that maxillary sinus disease may produce dental pain.

Other symptoms and signs of sinus infection may be so slight that the rhinologist himself will not immediately connect the mouth complaints with antritis. In other words, the pain is in many instances out of proportion to the disease. However, the two specialists working together should, after carefully comparing their findings, be able to give the patient relief. It is to promote this cooperation that this paper is prepared.

Every rhinologist knows that the mere application of epinephrine to the floor of the nose may put the patient's teeth "on edge." It is a common experience to have the patient complain of dental pain during a submucous resection in removing part of the vomer or the base of the anterior septal cartilage. Postoperative complaints in patients on whom a Caldwell-Luc operation has been performed are frequently referred to the teeth. These facts should serve to remind the rhinologist that the nerve supply of the antrum and that of the maxillary teeth are derived from the same trunk, and that the apical nerve branches are in contact with the walls of the antrum for some distance. Dentists are reminded of the association by seeing portions of the floor of the antrum in many of their roentgenograms of the maxillary teeth; by seeing the apex of a tooth root actually make an indentation in the antral floor. They know the danger of perforation into the sinus during extraction. Thus, both specialists should be constantly reminded of the possible reciprocity of symptoms in tooth and sinus disease. We present three cases of interesting dentorhinologic problems.

REPORT OF CASES

CASE 1.—H. E., a white man, aged 40, came in February 1938 for upper dental prosthesis. He had had numerous upper extractions during the last ten years, which left only the left second molar and four anterior teeth, three of these five having large fillings. It was decided to complete the extraction so that a full upper denture could be worn. Inspection of the roots of these teeth revealed no evidence of disease. The sockets healed normally. Three months later, the patient was discharged with a well-fitting plate having good suction.

Two months later, he appeared with the

complaint that the left side of the denture was uncomfortable and seemed to cause pain in the left side of the face at intervals. No local points of irritation were seen under or around the denture and there was no rocking of the denture. Roentgenograms of the gums revealed no root fragments nor impacted teeth. The patient stated that the pain disappeared on leaving the denture out for several days, and always reappeared when it was replaced, becoming worse the longer he wore it. The gums were tender on all surfaces throughout the left maxillary region. The problem resolved itself, then, into a case in which the patient was unable, because of pain, to wear an artificial denture, and with no positive dental explanation of the cause. The case was therefore referred to the rhinologist.

Nose and throat examination, July 14, 1938, revealed some tenderness on heavy pressure over the left antrum. However, the antra were equally clear on transillumination. The roof of the mouth was explored for tenderness with the edge of a tongue blade. Pain was elicited from a sagittal plane through the center of the hard palate over the entire left side, extending up over the outer margin of the gums on the upper left side. As compared with the right, the left lower turbinate was edematous and very red. The left middle turbinate was also somewhat swollen and hyperemic, but not so markedly. Its close contact with the middle meatus precluded natural ostium irrigation at this time. No pus nor polyps were seen. Slides showed no eosinophils. The tonsils were cleanly out and the nasopharynx was not remarkable. Diagnosis of mild chronic nonpurulent inflammation of the left antrum was made. The sinus was irrigated with a normal salt and soda solution through a trocar inserted under the lower turbinate. The return was almost clear, containing a small amount of thin mucus. Two days later, the patient returned much improved, and able to wear the denture without pain. It was possible to wash the antrum through the natural ostium. Although advised of our complete cooperation through a recommendation that a series of six regular treatments be taken, the patient, for financial reasons, did not return for six weeks. He stated at that time that he had suffered no further trouble with the denture nor with his cheek. However, the lower left turbinate still showed some irritation, and natural ostium irrigation was again carried out. Since that time, he has had no further complaints and has worn the denture constantly without tenderness. He has been warned to consult the rhinologist at the onset of any coryza.

We believe it worthwhile to call attention to the simplicity of diagnosis and the meager treatment that has so far been satisfactory in this case, which would have offered an irritating and baffling problem to the dentist alone.

At this point, we should like to renew the discussion of a long unsolved dental problem. Most exodontists are familiar with the case of acute dental pain in the maxillary region in which no single painful tooth can be pointed out, the pain seeming to arise from two or three teeth usually lying adjacent and often posterior to the painful area. Nor can the dentist find any obvious disease to explain the condition, and roentgenograms are entirely negative; but the patient is suffering acutely and insists that something be done. So one or more teeth are removed, usually under local anesthesia, either block or infiltration. The teeth are carefully washed and inspected, but still show no cause for the pain. Examination of the socket with a dull probe shows that the antrum has not been entered. A few of the patients have no further pain, and they feel satisfied with the result. What is the explanation of this phenomenon? We believe that the condition may often be an acute basilar antritis. Its cure is accomplished unwittingly by the shrinkage and by the anticongestive action of the local anesthetic extending into the antrum and nasal wall, combined with the opening of lymphatic channels at the base of the antrum and the hemorrhage accompanying extraction.

Case 2.—C. K., a white man, aged 36, came in June 1938, complaining of sensitivity

in, and pain and tenderness around, the left canine tooth and the first upper left molar, both of which supported clasps of a partial denture. Neither tooth displayed any cavity or filling. The denture held four anterior teeth and one lateral incisor, the latter replacing two bicuspids on the upper left side. The patient had worn the plate without difficulty for four years, until, in the last two months, the symptoms enumerated had developed. He attributed the disturbance to the mechanical strain of the clasps on these teeth, and stated that on removal of the partial denture, the symptoms abated. The use of acetyl salicylic acid, which had been frequent, enabled him to wear the plate for several days. Examination of the teeth in question revealed no pathologic condition except a gum sensitivity. The roentgenograms were entirely negative. There was no abnormal gum redness. The clasps were in good adjustment. In the absence of a dental explanation of the complaints, the patient was referred to the rhinologist.

A history revealed that the trouble had started after an acute coryza, from which the patient had, as he thought, recovered. The left antrum was dark on transillumination, and pulling down the lower lids showed a marked difference in light intensity. Intranasal inspection revealed edema and redness of abnormal degree of both the left inferior turbinate and the left middle turbinate. There was a small amount of heavy white mucous exudate in the middle meatus. The septum was straight and the left side of the nose was normal. The tonsils were cleanly out and the pharynx and nasopharynx were clear and clean. Slides showed no eosinophils. A diagnosis of chronic nonpurulent left antritis, with mucus accumulation, was made.

After shrinkage of the region, it was found possible to enter the left antral ostium with an irrigating catheter, and the sinus was washed. Numerous small clumps of mucus were found in the returned solution. Although the symptoms were not present the next day, three weekly irrigations were given. The sinus had remained quiescent since the first treatment, and the patient has worn the denture without being conscious of it.

Case 3.—E. B., a white woman, aged 43, complained of pain of varying intensity in the right cheek and about the region of the root of the canine tooth. She stated that the onset had occurred about six weeks previously, early in July. The pain had not always been in the same region, having shifted at times to the left temple, the bridge of the nose and the left cheek. However, the symptoms were most often in the right canine fossa, and her dentist had extracted the right second bicuspid since it had a large silver filling. This had given no relief, and the symptoms had appeared in the left cheek also. The first bicuspid on the left, which also contained a filling, had then been extracted, although the dentist had advised the patient that he held little hope of improvement through such a procedure. The sockets had healed slowly.

Nose and throat examination showed that the two extraction sockets were granulating evenly. There was some tenderness at the gum margins of these cavities, but not more than is to be found in any healing after extraction. There was no tenderness of the roof of the mouth, although some was present high up on the gums on the right side. Transillumination showed that both antra were dull. Intranasal inspection revealed generalized edema and marked redness. Slides showed almost every cell an eosinophil. A diagnosis of allergic sinusitis was made. A routine questionnaire pointed to tomatoes (raw) as the allergin, and the patient was instructed to eliminate this item from her diet. Three days later, she was free from all pain for the first time in six weeks, and the nose had returned to normal appearance. She has had no further trouble.

CONCLUSIONS

1. Infections and allergic sinusitis may be responsible for dental complaints.

2. Diagnosis and treatment are simple, these cases being treated even without roentgenograms of the sinuses.

3. Cooperation of dentist and rhinologist is urged.

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HISTOLOGIC CHANGES IN THE TEETH OF DOGS FOLLOWING PREPARATION OF CAVITIES OF VARIOUS DEPTHS AND THEIR EXPOSURE TO ORAL FLUIDS*

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THAT the connective tissues of the teeth, i.e., the pulp and its associated dentin, respond to many external stimuli has often been demonstrated. In spite of the vast amount of information available with respect to histologic changes in tooth tissues, the subject can, we believe, still be studied to good advantage by means of controlled laboratory experimental work. It is hoped that such an analysis can be made by studying tooth tissues of dogs subjected to systematically applied operative procedures. A brief survey of the literature, taken mainly from textbooks, reveals some of the evidence already gained from studies of clinical and laboratory material, and indicates, we believe, the necessity for further methodical laboratory work.

Stimuli may pass through cracks in the enamel to the dentin and pulp. They also may pass through various thicknesses of dentin denuded of its enamel by abrasion, erosion, gingival recession, caries or operative interference.[1] According to Beust,[2] responses to these stimuli may be manifested by a change in the permeability and optical properties of the dentin. He presented evidence of "sclerosis" by demonstrating areas of opaque and transparent dentin which were resistant to the penetration of stains. These changes he associated with injuries to the enamel and dentin, and with ageing of the tooth, which he called "maturation."

Feiler[3] showed that with the increasing age of the tooth and deficiencies of the enamel, there was a decrease in the number of tubules and in the cross-sectional area of the tubules. He attributed this decrease in tubule number and diameter to increased calcification because of age and dentinal irritation.

Kronfeld[4] and others have called attention to the fact that in addition to changes produced in the dentin by age, there are also changes in the histologic picture of the pulp. It is well known, for instance, that the pulp undergoes retrograde changes, such as reticular atrophy, fatty infiltration and calcification, with increasing age. In addition to these slow changes, there are more acute ones which may occur in the dentin and pulp as a result of bacterial, chemical and thermal stimulation. These agents may extend through the dentin to the pulp or may gain access by direct pulp exposure. The type of reaction found in the pulp varies considerably and, of course, depends on several conditions, such as the intensity of the irritant, the resistance of the tissue and the length of time after the irritation.

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With respect to experimental pulp injury through operative procedures in the dentin, Fish[1] offers the following information: "The degree of severity of the reaction in the pulp appeared to depend upon experimental factors, such as the depth of the original cavity, whether or not the dentin was overheated by the bur in cutting the cavity, and finally whether a dog or monkey was used."

Manley[5] states that no reaction need take place in the pulp as a result of mechanical injury to the peripheral ends of the dentinal fibrils through the cutting of a cavity.

For a complete consideration of the possible changes taking place in teeth, the reader is referred to the bibliography attached to an article by E. Dolder.[6]

The work of Von Korff and Orban[7] has shown conclusively that the pulp contains all the essential elements of a true connective tissue. Orban, in 1929,[8] wrote: "It is known that connective tissues react to bacterial, mechanical and chemical irritations in practically the same way;

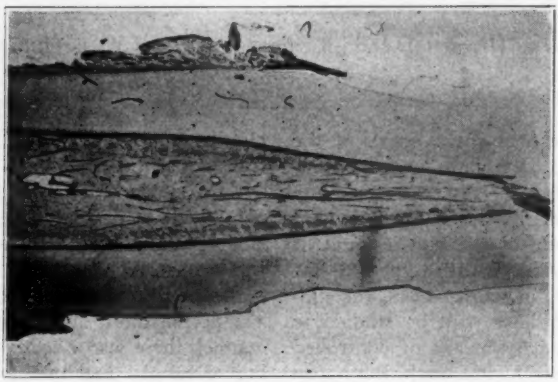

Fig. 1.—Canine tooth of dog 31. The cavity floor is 0.85 mm. from the pulp chamber and it was exposed four days. No histologic alterations are visible.

Fig. 2.—Maxillary right canine tooth of dog 33. The cavity floor is 0.75 mm. from the pulp. There is a clear area in the pulp periphery opposite the cavity.

namely, with inflammation." It has occurred to us that the pulp connective tissue seems, for the following reasons, particularly suited to the study of connective tissue responses to injury: 1. In the young animal, the dental pulp is isolated and protected. 2. The pulp in the young animal is large and unchanged. 3. The enamel and dentin coverings can be removed at will, and varying distances from the pulp can be established. 4. In addition to being able to change the concentration of injurious agents by varying the distance from the cavity floor to the pulp chamber, one can also use various types and concentrations of irritants and accurately seal them in the cavity. 5. Orban[8] has shown with excellent illustrations that pulp tissue can be prepared for histologic study even though the hard unyielding peripheral tooth substances must be subjected to acid decalcification.

Fig. 3.—Higher magnification of Figure 2, showing the more clearly lightly stained area in pulp periphery. There is an occasional small round cell present. (16 mm. obj.; 10× eyepiece.)

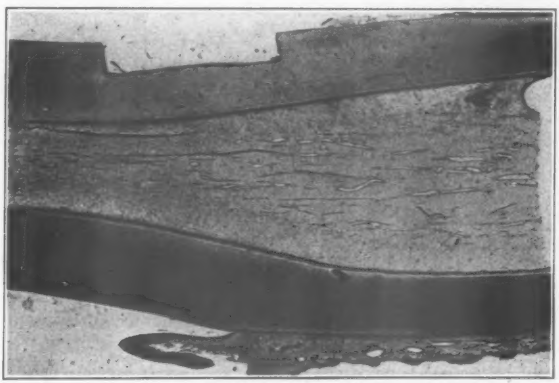

Fig. 4.—Mandibular right canine tooth in dog 33. The cavity floor is 0.73 mm. from the pulp. There is a slight thickening of the odontoblastic layer opposite the incisal end of the cavity.

Cognizant that physiologic changes take place in dentin and pulp as a result

of age and mechanical stimuli, we early realized that teeth from young animals must be used. As it would require a great amount of time, space and extra money to raise animals and thus determine their chronologic age, it was considered more expedient to select them by a consideration of their physiologic age according to the following signs: 1. The animal must have finished (clinical) eruption of the permanent dentition. 2. There must be no abrasion visible to the unaided eye on the biting surfaces of any of the teeth. According to these criteria, dogs were selected from the city pound for use in the present work.

PURPOSE

It is purposed in this study to show the histologic changes that take place in the pulps of young dogs' teeth four, six and eight days after the preparation, and exposure to oral fluids, of shallow, medium and deep cavities.

Fig. 5.—Higher magnification of Figure 4, showing slight round cell infiltration and edema of pulp periphery.

Fig. 6.—Right maxillary canine tooth in dog 32. The cavity floor is 0.73 mm. from the pulp and was exposed for eight days. The two sides of the pulp and the dentin are essentially the same.

METHOD

In this study, cavities of different depths were slowly prepared in the gingival one-third of the labial surfaces of certain anterior teeth of selected dogs. These cavities were then left open to the mouth fluids for periods of four, six and eight days before the animal was killed and the teeth were removed for histologic sectioning. At the end of the experimental period, the dogs were anesthetized with nembutal (pentobarbital sodium) injected intravenously. The abdomen was opened, the diaphragm cut along the left body wall and a cannula directed toward the head tied into the thoracic aorta. The upper extremity and head were then perfused with a physiologic sodium chloride solution at 45 degrees (temperature of solution when placed in perfusing apparatus). The external jugular veins were opened and the saline solution was permitted to flow until the fluid coming through them was clear. The solution was then followed by a 5 per cent neutral formaldehyde

Fig. 7.—Higher magnification of Figure 6. (16 mm. obj.; 10× eyepiece.) There is a slight round cell infiltration of the pulp, with separation of the odontoblastic layer.

Fig. 8.—Maxillary third incisor of dog 31. The cavity floor is 0.45 mm. from the pulp and it was exposed for four days. Thickened blood vessel walls are visible opposite the deep end of the cavity.

solution at the same temperature. The formaldehyde solution was permitted to flow until it stopped of its own accord, in all probability because of the fixation and occlusion of the vessels.

It has been our experience that unless the animal is perfused with saline solution, the capillaries of the pulp remain filled with red blood cells, which gives otherwise normal pulps the appearance of hyperemia. Perfusion of the head, and thus of the pulps of the teeth, may result in a certain amount of histologically visible edema, a fact that was always kept in mind and taken into account in the study of the sections. It is believed that the cells of the pulp appear more nearly in their normal shape when the animals are perfused with a warm formaldehyde solution. The basis for this statement is that ameboid cells with pseudopodia processes are seen in material treated this way more often than when the teeth are simply extracted and placed in the fixing solution.

The teeth operated on were removed

Fig. 9.—Higher magnification of Figure 8. (16 mm. obj.; 10× eyepiece.) The vessels are surrounded by infiltrating cells. There is also a moderate infiltration of the pulp periphery.

Fig. 10.—High magnification of Figure 9. (4 mm. obj.; 10× eyepiece.) This shows polymorphonuclear leukocytes and polyblasts.

surgically, and only those were saved in which the apex appeared wide open. The root of the tooth with its pulp was then cut off to within about 2 mm. of the anatomic neck and the remaining portion of root and crown placed in Zenker's formol solution. The teeth were then treated according to the method outlined by Orban[8]; that is, they were decalcified in 5 per cent nitric acid for five days, embedded in colloidin, cut 15 micra thick and stained with hematoxylin, eosin and azure.

Figure 1 shows a histologic section through the maxillary right canine tooth of dog 31. In this illustration, the tissues are magnified about thirty times. The cavity extends through the enamel into the dentin, the floor being 0.85 mm. from the pulp chamber. The pulp in this section appears wide. The sum of the width of the dentin on both sides is only one and one-half times the width of the pulp. This large pulp gives little or no histologic evidence of atrophy and the dog's teeth showed no abrasions at the time of

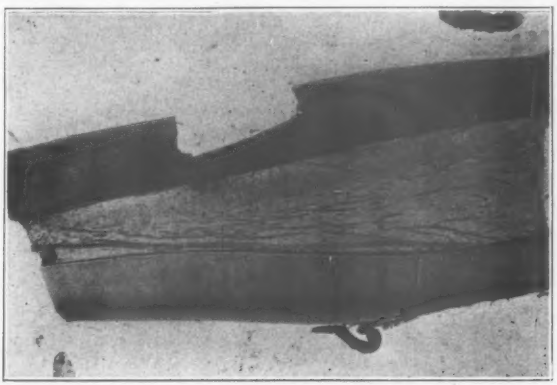

Fig. 11.—Maxillary right canine tooth of dog 35. The cavity floor is 0.34 mm. from the pulp. There is a small area of cellular infiltration opposite the deep end of the cavity.

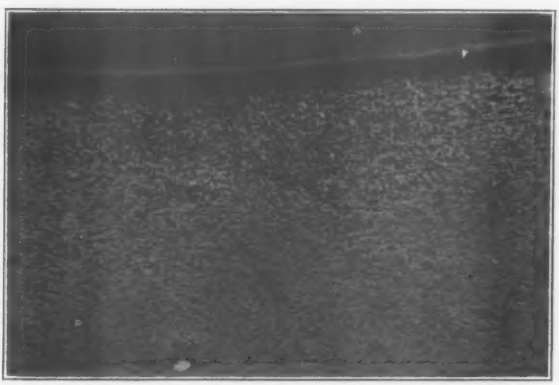

Fig. 12.—Higher magnification of Figure 11. (16 mm. obj.; 10× eyepiece.) There is a moderate cellular infiltration of the pulp near the odontoblastic layer.

inspection. This indicates that this permanent tooth is from a young adult animal, and supports the postulates set up in the introduction. Therefore, it is considered usable in this study.

The outline of the pulp chamber nearest the cavity is regular, curving toward the other side to form the coronal pulp horn. The odontoblastic line is undisturbed, following the even curve of the periphery of the pulp chamber. The sides of the pulp chamber toward the open cavity and the undisturbed side appear at this magnification to be essentially the same.

Higher magnification of the same section taken through a microscope using a 16 mm. objective and a 10× eyepiece also reveals undisturbed dentin and pulp tissue.

Fig. 13.—High dry magnification of Figure 11. (4 mm. obj.; 10× eyepiece.) This shows the round cells infiltrating the pulp tissues.

Fig. 14.—Left maxillary canine tooth of dog 32. The cavity floor is 0.32 mm. from the pulp and was exposed for eight days. There is a dark "line of injury" in the dentin close to the pulp.

If one examines this section using a 4 mm. objective and a 10× eyepiece, there is visible in the gingival half of the cavity on the exposed dentin surface a

matlike layer of blue-staining material. This resembles the threadlike growth of organisms often described as occurring on enamel surfaces.[9] No study is made of this material in an attempt to identify it. As far as one can see, under the microscope, there is no penetration of these threadlike forms either into the substance of the dentin or into the dentinal tubules. Parts of the cavity contain débris mixed with the mass of threadlike organisms, if they are organisms.

In the next case, Figure 2 shows a shallow cavity in the maxillary right canine tooth of dog 33. The cavity floor is 0.75 mm. from the odontoblastic layer. Examination of this illustration shows that a wide area of the periphery of the pulp opposite the cavity floor is stained lighter than the bulk of the pulp. The only explanation of this phenomenon occurring to us is that it may represent a thinning of the elements of the pulp in this area due to edema. The layer of predentin on this side is definitely thinner and more irregular than it is on the opposite side of the pulp. The odontoblastic layer is normal in its depth and solidity when compared with that on the other side of the pulp chamber.

Figure 3 shows a photomicrograph taken through the microscope using a 16 mm. objective and a 10× eyepiece. This illustration reveals the lighter staining area in the pulp periphery adjacent to the cavity. There is in this area a very slight infiltration of small round cells which contain a small round, dark blue stained nucleus, eccentrically placed in about an equal amount of paler staining blue cytoplasm.

In Figure 4, a histologic section through the mandibular right canine tooth of dog 33, magnified thirty times, the floor of the cavity is 0.73 mm. from the odontoblastic layer. The total thickness of dentin in this area was 1.25 mm. As the cavity floor is less than half way into the dentin, the cavity is classified as a shallow one. Close inspection of Figure 4 and the higher magnification, Figure 5, reveals no alteration in the dentin or predentin. The odontoblastic layer opposite the incisal end of the cavity is slightly thickened. The cellular elements, basic substance and vessels are not noticeably changed. There are, however, an exceedingly small number of small round cells diffused through the pulp tissue proper at a slight distance in from the odontoblastic layer on the affected side. There is also some edema of the

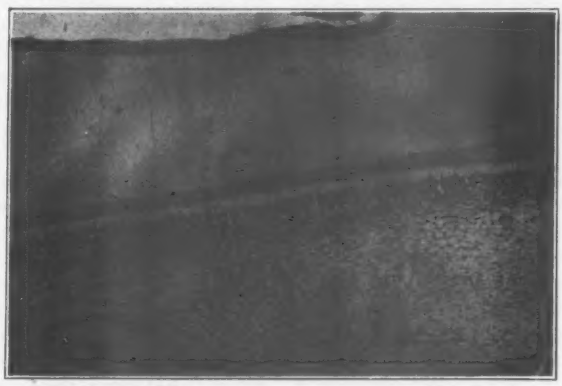

Fig. 15.—Higher magnification of Figure 14. (16 mm. obj.; 10× eyepiece.) There is visible a dark "line of injury" and a slight cellular infiltration of the pulp. The cavity floor is covered with a dark staining matlike substance.

pulp periphery. This cavity is slightly, though not significantly, deeper than the one previously described, and the reaction with respect to cellular infiltration of the pulp is essentially the same.

The floor of this cavity left open to the oral fluids for a period of six days shows a marked covering of a threadlike growth similar to that observed in the other sections.

Figure 6 shows a histologic section through the right maxillary canine tooth of dog 32. This section has been magnified about thirty times and reveals the presence of a cavity, the floor of which lies at its deepest portion 0.73 mm. from the odontoblastic layer of the pulp. As the total thickness of the dentin at this point was 1 mm., the cavity is classified as a shallow one. It was left open to the oral fluids for a period of eight days.

The tissues at this magnification show no alterations. The odontoblastic layer, the dentin, predentin and pulp periphery are the same on the side next to the cavity as they are on the opposite side of the tooth.

Figure 7 is a higher magnification of pulp and dentin adjacent to the pulpal ends of the tubules cut during the cavity preparation. This illustration was made by photographing the slide, using the microscope with a 16 mm. objective in combination with a 10× eyepiece. Examination reveals some round-cell infiltration, a slight separation of the odontoblasts and a small increase in the depth of this layer. The layer of predentin does not seem abnormal. The fibroblasts and other elements of the pulp are apparently undisturbed. This cavity floor is about the same distance from the pulp as the one in Figures 2 and 4 and presents essentially the same picture.

Figures 8, 9 and 10 illustrate three different magnifications of a histologic section through a maxillary incisor tooth of dog 31. The deepest portion of the cavity is more than half way through the dentin and is situated 0.45 mm. from the pulp. The dentin between the cavity floor and the pulp in this case is from 40 to 50 per cent thinner than it is in the previous cases. Examination of Figure 8 reveals at this magnification (about thirty times) cellular infiltration of the periphery of the pulp opposite the deep end of the cavity and, in addition, four or five small areas resembling thickened blood vessel walls.

Figure 9 is the affected area photographed through the microscope with a 16 mm. objective and a 10× eyepiece. It shows with more detail the area mentioned above, described as appearing to contain thickened blood vessels.

At this magnification, these areas are shown to be thickened blood vessels surrounded by fairly dense areas of cellular infiltration. The surrounding pulp tissue and the attenuated odontoblastic layer is also moderately infiltrated with cells. The dentin margin is irregular and has a thin dark stained border along the pulpal side. The layer of predentin is absent.

Figure 10 reveals the same area photographed through the microscope with a 4 mm. objective and a 10× eyepiece. In this illustration, because the infiltrating cells are close together and the section is thick (about 15 micra), one has difficulty determining from the photograph what type these infiltrating cells are. Examination of a less dense area under the microscope shows that these cells are predominantly polymorphonuclear. The pulpal border of the dentin, which under normal circumstances stains lighter than the remaining part, in this case stains darker than the bulk of dentin and looks like the "area of injury" referred to in a previous paper.[10]

Examination of the cavity floor in this section reveals one small patch of threadlike organisms separated slightly from the cavity floor.

Figure 11 shows one of the serial sections through the maxillary right canine tooth of dog 35. The distance from the floor of the cavity to the pulp is 0.34

mm. The total thickness of the dentin wall in this area is 1.05 mm. The cavity is deep, with only about one-third of the thickness of dentin remaining between it and the odontoblastic layer. This low magnification (about thirty times) discloses in the pulp chamber close to the odontoblastic layer and opposite the deepest end of the cavity a small area of cellular infiltration. The margin of the pulp periphery and the odontoblastic line at this point are even and of uniform thickness. The layer of predentin is present and at this magnification is apparently normal.

Figure 12, a photomicrograph of the affected pulpal area shown in Figure 11, was made with a 16-mm. objective and a 10× eyepiece. One can see that the dentin, the predentin and the odontoblastic layer are practically normal. They are both of normal thickness and the odontoblastic layer has an even density and spacing of its cells. The pulp tissue in this region is definitely though diffusely infiltrated with cells; there are no localized concentrations of the infiltrating cells; the capillaries are not noticeably increased in number, and there are no collections of cells about any of the existent capillaries. The fact, then, that the tissue is infiltrated with cells which are not closely related to disturbed capillaries might lead one to believe that the infiltration is made up of histiocytic rather than vascular cells.

Figure 13, an illustration made by photographing the area through the microscope with a 4-mm. objective and a 10× eyepiece, shows that the majority of the infiltrating cells are of the plasma type. Their nuclei are round or kidney shape, stain dark blue and appear densely stained without showing any details such as chromatin granules or nucleoli. The cytoplasm of these cells stains a pale blue and is irregular in its outline, suggesting in many instances pseudopodia. Whether these are plasma cells or polyblasts one hesitates to state. Their diffuse arrangement at a distance from the blood vessels leads one to believe that their origin is local. There are also present in this area a few polymorphonuclear leukocytes and a few small round cells. The infiltrating cells in this section contrast strikingly with those in the previous section, where one can see that the majority are definitely clustered about blood vessels and are polymorphonuclear.

Figure 14 is a photomicrograph of a histologic section taken through the left maxillary canine tooth of dog 32. This section, magnified 30 times, reveals a cavity the floor of which is at its deepest portion 0.32 mm. from the odontoblastic layer of the pulp. As the total thickness of the dentin was 1.25 mm., the cavity is classified as a deep one. It was left open to the oral fluids for a period of eight days. The illustration shows a slight thickening of the odontoblastic layer, and a dark line in the dentin, peripherally from and close to the dentinoid layer. This dark line also appears in Figure 15. One can see no appreciable change in the other parts of the section at this magnification.

Figure 15 is the histologic section shown in Figure 14 photographed through the microscope with a 16-mm. objective in combination with a 10× eyepiece. In this illustration, one can see a dark line at the edge of the dentin close to the dentinoid layer. The dentinoid layer is slightly thicker directly opposite the cavity floor than it is to the right of it. Examination of the pulpal border of the dentinoid and odontoblastic layers shows that they diverge from the line of the pulp cavity at the right of this obviously injured area. The odontoblastic layer is slightly attenuated and slightly deeper, and there is an apparent small increase in the number of fibroblastic cells.

Examination of this area of infiltration with the use of a 4-mm. objective and a 10× eyepiece shows that there is a slight

increase in the number of cells. The infiltration is a diffuse one composed of large histiocytes, small round cells or lymphocytes and some plasma cells. There is no apparent increase in the capillaries nor any marked infiltration of leukocytes about the capillaries.

In the accompanying table, the teeth are listed according to the thickness of the dentin remaining between the cavity floor and the pulp chamber. In the first column are the illustration numbers; in the second column, the dog numbers and tooth annotations; in the third column, the thicknesses of dentin between the pulp and the cavity; in the fourth column, brief descriptions of the reaction, and in the fifth, the elapsed time intervals between the cavity preparation and the removal of the tooth.

CONDENSED FINDINGS

Illustrations	Tooth Number	Cavity Floor Odontoblastic Layer	Reactions	Time Interval
	Dog	Min.		Days
1	31 4 ⌟	0.85	None	4
2,3	33 4 ⌟	0.75	Slight round cell	6
4,5	33 4 ⌝	0.73	Slight round cell	6
6,7	32 4 ⌟	0.73	Slight	8
8,9,10	31 3 ⌟	0.45	Marked polymorphonuclear	4
11,12,13	35 4 ⌟	0.34	Marked histiocytic	4
14,15	32 4 ⌞	0.325	Marked*	8

*This reaction shows slight pulpal infiltration but decided dentin changes (line of injury).

One can see from this table that there is some correlation between the thickness of the remaining dentin and the degree of reaction. There is, however, no apparent correlation between the thickness of dentin and type of reaction taking place in the pulp.

COMMENT

These illustrations have been assembled to show the histologic changes which follow the cutting and subsequent exposure of the dentin to oral fluids. It is apparent that it is only necessary to remove less than half the thickness of the dentin and leave the cut surfaces exposed to the oral fluids for a short period of time to produce some cellular infiltration of the pulp periphery. The reaction taking place in all but one of the above-described cases is manifested not by changes in the odontoblastic layer or disturbances of the dentin, but by an increase of cells in the pulp tissue proper. Examination of the table shows that the closer the cavity floor is to the odontoblastic layer, the more marked is the resulting reaction. In the majority of cases, this increased reaction is within the pulp proper. In the first instance, where the cavity is a shallow one, there is no visible reaction. The next two cavities, though they are not deep, are about 10 to 15 per cent closer to the pulp than the first one. The histologic sections show a slight cellular infiltration of the pulp periphery.

In the case of the maxillary right third incisor tooth of dog 31, shown in Figures 8, 9 and 10, the cavity is much deeper (40 per cent closer to the pulp) than the two preceding cavities. In this case, there is visible a marked polymorphonuclear infiltration indicative of a definite acute reaction of the pulp. In this case,

there is also visible in the pulpal edge of the dentin a dark area indicating increased calcification.

In Figures 11, 12 and 13, though the cavity is still deeper than in any of the previous cases, the reaction, though marked, is not polymorphonuclear. On the other hand, the cells are histiocytic.

In the last case (Figs. 14 and 15), in which the cavity is placed relatively close to the pulp, the resulting reaction is differently manifested. Here, one can see a disruption of the odontoblastic layer, a dark line in the dentin pulpal border and a deficiency of dentinoid substance, with relatively little cellular infiltration of the pulp.

Fish[1] shows illustrations in which there is a dark line separating primary dentin from secondary dentin in teeth affected by abrasion and operative injuries. He shows that the tubules are fewer on the secondary dentin side of the line than in the primary dentin. He also shows that centripetally to this secondary dentin, the odontoblastic layer is disturbed; that is, the odontoblasts are fewer. He attributes this change to an increased calcification in the area of the dark line. This results, he states, in a reduction of some of the tubule diameters, as well as an actual reduction in the number of tubules, with a corresponding loss in the number of odontoblasts. The dark line described by Fish and seen in Figures 9, 10 and 15 may be logically accredited to increased calcification. This is particularly true when it is realized that in decalcified histologic sections, areas of calcified bone or dentin matrix take up more of the hematoxylin stain than newly formed uncalcified hard tissue matrix. Areas of increased calcification will accordingly, when decalcified and stained, take up more of the hematoxylin than otherwise. In those cases showing a dark line of injury between the secondary dentin and the primary dentin, Fish believes that an increased calcification has taken place. This, he states, provides an interruption of and a reduction in the number of tubules, thus preventing further injury to the pulp proper.

In Figure 14 and 15, there is no evidence of an interruption of or decrease in the tubule number at the dark "line of injury." The darker staining dentin may indicate an increased calcification. The odontoblastic layer is changed and there is a deficiency in the amount of dentinoid substance with little infiltration of the pulp. In addition to the fact that the tubules are not interrupted, there is a deficiency of the dentinoid substance. In Fish's findings, there is not deficiency of dentin substance, but an increased layer of secondary dentin. The sections exhibited by Fish, however, represented longer reaction periods following injury.

From this evidence, there is no doubt that cavity depth has something to do with the severity of pulpal reaction. The type of reaction which takes place, however, varies considerably in different cases, and the variations cannot be predicted or explained from the evidence obtained so far.

SUMMARY

1. When cavities are made in the dentin and allowed to remain exposed to oral fluids, there may follow definite changes in the pulp or the marginal dentin.

2. The subsequent reaction apparently increases in severity with an increase in the cavity depth.

3. The type of reaction may be different in each case. It always involves the pulp tissue in varying degrees and it may also involve the predentin layer and the odontoblastic layer and may affect the deposition of dentin.

BIBLIOGRAPHY

1. Fish, E. W.: Experimental Investigation of Enamel, Dentine, and the Dental Pulp.

London: John Bale, Sons and Danielson, Ltd., 1933.

2. Beust, T. B.: Dental Histology and Embryology. Philadelphia: W. B. Saunders Co., 1934.

3. Feiler, E.: Beitrage zur Biologie des Zahnbeins und der Pulpa. Deutsche Monat. f. Zahnheilk., 1923.

4. Kronfeld, Rudolf: Histopathology of the Teeth. Philadelphia: Lea & Febiger, 1933.

5. Manley, E. B.: Preliminary Investigation into Reaction of Pulp to Various Filling Materials. *Brit. D. J.*, 60:321, April 1, 1936.

6. Dolder, E.: Silikatzementfulling und Zahnpulpa. Deutsche Zahnartzl. Wchnschr., 39, August 1936.

7. Orban, Balint: Development of Dentin. J.A.D.A., 16:9, September 1929.

8. Orban, Balint: Contribution to Histology of Dental Pulp and Periodontal Membrane, with Special Reference to Cells of Defense of These Tissues. J.A.D.A., 16:965, June 1929.

9. Beust, T. B.: Micro-Organisms and Caries. J.A.D.A., 17:1536, August 1930.

10. Gurley, W. B., and Van Huysen, Grant: Histologic Changes in Teeth Due to Plastic Filling Materials. J.A.D.A., 24:1806, November 1937.

PULP MANAGEMENT FOR DECIDUOUS AND YOUNG PERMANENT TEETH

By Kenneth A. Easlick, A.M., D.D.S., Ann Arbor, Mich.

A FRIEND of mine once opened a clinic before a Greater New York dental group with this statement:

Gentlemen, this afternoon I am presenting an alibi clinic. I have, here, the alibi which you are all going to use when you have a child patient under your regular care and you miss a cavity. You overlook it in your mirror and explorer examination, or you do not take interdental radiograms, or you do not have your patient return at frequent enough intervals, or you wait for a small cavity to get large enough to be filled. Your child patient does develop a toothache from an exposed vital pulp or an acute abscess, and you would give almost all you possess to be able to take care of the situation without the extraction of the tooth. The alibi that you will use is a pulpotomy or root-canal work.

The purpose of this paper is to present the operative dentist's alibi, and to point out some of the steps which make an alibi unnecessary. Probably all of the men who are practicing children's dentistry will agree that operative dentists alone now know enough preventive steps that there is no longer an excuse for toothache, barring accidents. If we would practice the preventive operative dentistry for children that we know, if our small patients would cooperate with us and if their parents could afford to pay our fee, toothache could be banished for every child under a dentist's regular care. In fact, with any child who is on our regular recall lists, to whom we are giving periodic interdental radiographic examination and for whom we are placing prophylactic fissure fillings, we should feel quite embarrassed and chagrined were exposure of a pulp to develop. The best pulp management in all children's dentistry is preventive operative dentistry, begun early and continued regularly.

In our collection, we have a right and left posterior interdental radiogram of the mouth of a 5-year-old boy who had eight interproximal cavities, not one

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of which was detected by the five operators who examined the boy's mouth with mirror and explorer. These two radiograms alone make a strong argument for more interdental radiographic examinations in a children's practice, if we wish to detect cavities while they are small.

A series of six radiograms of the mouth of one young girl patient, taken deep occlusal fissure. At 7, the roots had become much better defined and the tooth showed the same deep occlusal fissure. At 8, a fine dark line appeared at the dentino-enamel junction. At 9, a very definite cone of decalcification appeared in the dentin. At 10, the decalcified area in the dentin penetrated close to the mesial pulp horns. Two months later, another radiogram showed

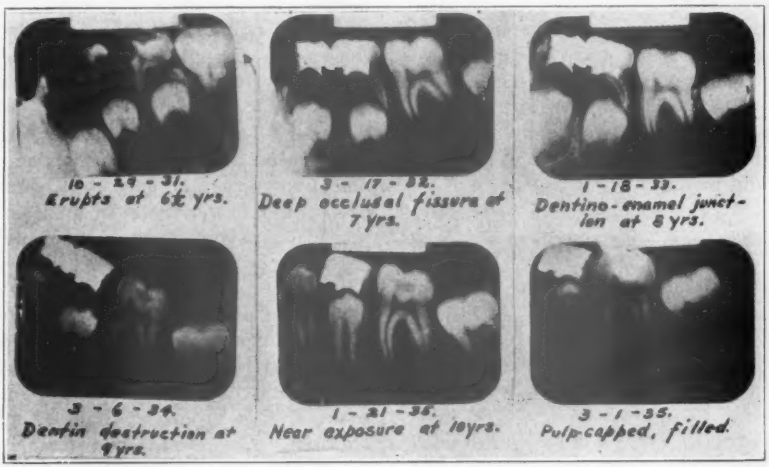
10 - 29 - 31.
Erupts at 6½ yrs.
3 - 17 - 32.
Deep occlusal fissure at 7 yrs.
1 - 18 - 33.
Dentino-enamel junction at 8 yrs.
3 - 6 - 34.
Dentin destruction at 9 yrs.
1 - 21 - 35.
Near exposure at 10yrs.
3 - 1 - 35.
Pulp capped, filled.

Fig. 1.—Progress of caries. A prophylactic fissure filling at 6½ or even 8 years would have made the pulp capping at 10 years unnecessary.

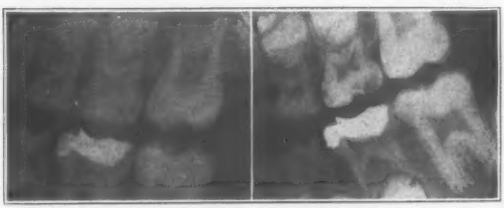

Fig. 2.—Reduction of ammoniacal silver nitrate solution over nearly exposed deciduous molar pulp, cement base and silver amalgam filling. Right: Radiogram taken one year and two months after treatment.

during a four year period, furnish further material for a sermon on pulp management by preventive operative dentistry. (Fig. 1.) At 6½ years, the first permanent molar had just erupted. Its roots had not yet become calcified, and it had a how very closely the operator approached the pulp when he inserted the filling. This cavity, at 10, required an hour's time for filling. The pulp had been very carefully protected. The operation was painful and expensive, and the

operator was confronted by the thought that the pulp may still degenerate. If a narrow fissure filling had been placed soon after the tooth erupted, the operation would have been quite painless, would have taken little time and cost little and the pulp would have been well protected. A prophylactic fissure filling at 6½, or at 8, even, would have prevented a near pulp exposure and pulp capping at 10 years.

From 1 to 5 per cent of the children of this country are immune to dental caries. For them, pulp management is a biannual prophylaxis only. For the 95 to 99 per cent of susceptible child patients, we shall have to practice varying degrees of pulp management.

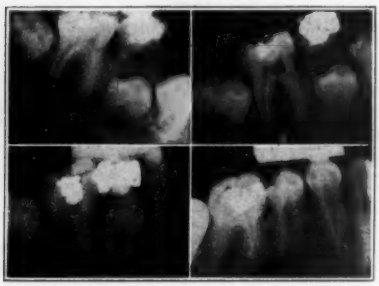

Fig. 3.—Pulpotomy of vital deciduous molar under local anesthesia in a patient aged 7 years. Above, left, radiogram taken 11-6-31; right, 3-18-33. Below, left, radiogram taken 5-10-34; right, 1-26-35.

PULP MANAGEMENT FOR DECIDUOUS TEETH

Cavity Sterilization.—The simplest measure that we have to practice is sterilization of a shallow cavity in a deciduous tooth. It is, at the same time, the most illogical phase of our practice. As far as can be ascertained, few have a very clear notion about how far a sterilizing agent penetrates dentin, whether it should be a lipoid solvent, whether it should be a protoplasm coagulant or whether it should have a low, average or unusually high phenol coefficient to selected strains of bacteria in the laboratory. As a result of what we do not know, some of us maintain a time-hallowed routine of "alcohol after phenol"; some of us employ phenol alone; some of us use hexylresorcinol; some of us reduce an ammoniacal solution of silver nitrate with formalin or eugenol, and some of us get along without the use of anything. This paper will not present the answer to cavity sterilization.

Deep Deciduous Tooth Cavities.—As the shallow cavity becomes deep, all children's dentists begin to think more seriously about cavity sterilization, about varnish and about an insulating cement liner, medicated or non-medicated. In our children's clinic, since 1931, we have been routinely reducing an ammoniacal solution of silver nitrate with eugenol on all the deep deciduous molar cavities and lining them with zinc oxyphosphate cement. For a test, twenty-two deciduous teeth with nearly exposed pulps were selected during the summer of 1935. These deep cavities were found in the mouths of a group of indigent school children. The twenty-two teeth were given our routine clinical treatment of ammoniacal silver solution (reduced by eugenol), zinc cement base and silver amalgam filling. A year from the following fall, these children were returned for examination and radiograms. (Fig. 2.) But one of the twenty-two teeth had degenerated in more than a year.

Exposed Vital Deciduous Pulps.—As the cavity in a deciduous tooth grows progressively worse or we fail progressively further, we are confronted by a vital exposed pulp. This condition is the hardest problem which has confronted us as we have developed modified operative procedures to care for deciduous teeth. We have had numerous precedents for procedure, but something seemed wrong with all of them.

In the first place, we might have turned 100 per cent extractionists and joined that group of dentists who will not tol-

erate a pulpless tooth in any patient's mouth. Clarence O. Simpson, in his "Toothsome Topics," dates the 100-per-centers back to the time of the "Gay 90's." At that time, all children's dentistry was practiced with forceps; hence, 100-per-cent extraction is "Gay 90's" dentistry to him. Simpson says:

In those days when children gathered at a family reunion, they always ate at the second table and never knew that chickens had anything but necks. Similarly, when these children went to the dentist, they sat in his dental chair in fear and trembling, and they never knew that the dentist had anything but forceps.

A number of our orthodontist friends frequently become upset by the early extraction of deciduous teeth. In fact, some of them make very pointed remarks about operative dentistry which permits the loss of space and contributes to malocclusion. Extraction is going to become increasingly distasteful to the children's dentist who is interested in his young patient's future, adult occlusion.

We might have chosen to practice pulp capping, if we had believed the advertising of the numerous proprietary pulp-capping preparations. In the cases that we have been able to follow, we have been unable to successfully cap exposed pulps in deciduous teeth. We have tried cresatin, "Thymozin," thymolized zinc oxide, "Steridents No. 1 and No. 2," "Silv-O-Dent," "Carbol Eugenol," "Jodo-Formagen" and some others without success. Dr. Gordon, who analyzed a number of these preparations while he was secretary of the Council on Dental Therapeutics, concludes that we, as operative dentists, put considerable faith in zinc

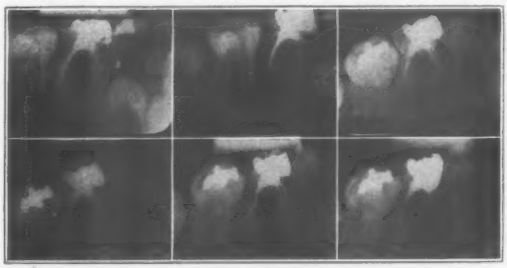

Fig. 4.—Case in child aged 6 years. A lower second deciduous molar without a permanent successor was devitalized, the root canals were filed and a filling of root paste and guttapercha points was inserted in 1932. In 1937, the partially resorbed root ends became infected. Above, left, radiogram taken 5-27-32; center, 2-25-33; right, 4-16-34. Below, left, radiogram taken 4-2-35; center, 1-23-36; right, 1-21-37.

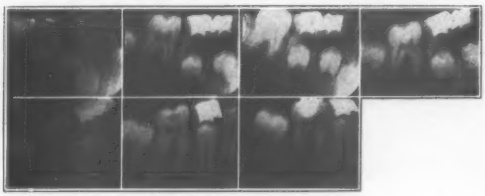

Fig. 5.—Pulpotomy of deciduous molar after devitalization by paraformaldehyde paste in patient aged 6½ years. Above, left to right, radiograms taken 10-29-31, 3-17-32, 5-24-32, 1-18-33. Below, left to right, radiograms taken 3-6-34, 1-21-35, 3-1-35.

oxide and eugenol. These are the usual constituents of the proprietary products for which we have paid a high price.

In 1933, at Buenos Aires, Chaneles[1] reported the successful capping of exposed pulps in carefully selected deciduous teeth. He used zinc oxide and eugenol as a pulp-capping paste. In 1937, Rosenstein[2] reported some studies that were made in the infirmary of the Columbia School of Dental and Oral Surgery. Eighty per cent of a group of returned cases, in which actually exposed pulps were capped in deciduous teeth by zinc oxide-eugenol, thymol-zinc oxide-eugenol, zinc oxide-powdered silver nitrate-eugenol was found to be successful. Recent work by Gurley and Van Huysen[3] on dog teeth shows that, under a deep cavity which has been protected by zinc oxide and eugenol, there is no pulp reaction. We hope to check carefully further clinical cases to see whether we can confirm this experience. A study has just been started on dog teeth in which deep cavities and artificial exposures have been made and the pulp protected by various materials. The exposed pulp, which was capped in April by zinc oxide, silver nitrate and eugenol, showed, at the end of August, a penetration of granules of silver into the pulp tissue and necrotic tissue about the site of the exposure. The odontoblastic layer inside the dentin and the periapical tissues, however, remained healthy. We are not yet discouraged by the possibilities of capping vital exposed pulps of deciduous teeth in selected cases.

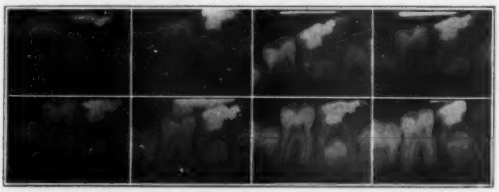

Fig. 6.—Case in child aged 6 years. Above, left to right, radiograms taken 2-28-31, 3-6-31, 5-27-32, 4-2-33. Below, left to right, radiograms taken 1-14-34, 2-3-35, 1-19-36, 2-1-37. The tooth exfoliated in May 1937.

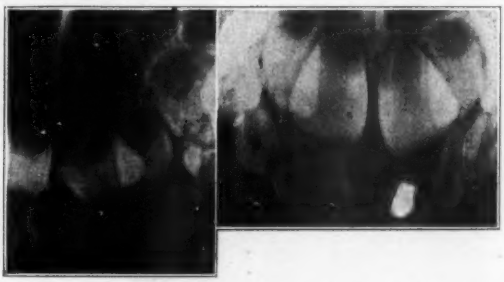

Fig. 7.—Case in child aged 2 years 11 months. The right deciduous incisor, in which the pulp was destroyed in a fall, became infected and was treated and filled without a culture. Left, radiogram taken 5-11-36. Right, radiogram taken 10-27-37, revealing rapid resorption of root. Two cultures grew pure strains of Staphylococcus albus.

We might have continued with a vital pulpotomy of these deciduous teeth when they presented exposed pulps (which we started to do). However, the use of local or block anesthesia is quite upsetting to many small children, particularly the first

time it is used, and it may therefore create a patient-management problem. In addition to the management drawback, an amputated pulp sometimes bleeds profusely in spite of almost any styptic which may be used. (Fig. 3.)

In a few cases, we tried low pressure anesthesia for the vital pulpotomy cases, as has been advocated at a few of the dental schools. We could not produce anesthesia without hurting the patient.

We might have adopted the method used by many children's dentists and have sealed in an arsenic wafer, fiber or disk to devitalize the vital exposed pulp. In our clinic, we were opposed to the use of arsenic, however, for fear that it might get out from under its temporary sealing or through a partially resorbed root end and induce an arsenic necrosis.

We might also have adopted Dr. Ger-

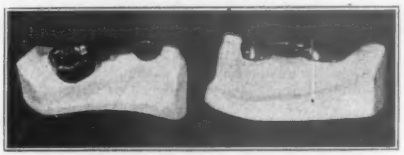

Fig. 8.—Cast overlay space retainer that will not interfere with lateral jaw growth in cuspid region.

lach's[4] technic and devitalized exposed pulps, filed the root canals and filled the root canals with paste and guttapercha points. Root-canal dissections of deciduous molars showed us flat ribbon-like canals with considerable variation in number. We became skeptical of our ability to place adequate fillings and we found that parents were unwilling to pay for the amount of work involved. (Fig. 4.)

As a result of our dissatisfaction with developed technics, we prepared a devitalizing paste in which paraformaldehyde was employed as the devitalizing agent. We combined devitalization with pulpotomy of the coronal pulp and we found that we had a simple, adequate treatment for a vital exposed pulp in a deciduous tooth. We found further that parents were willing to pay our fee for the amount of work that such pulp management involved.

Immediately the exposed pulp is found, during our first appointment with a child patient, we touch the cavity with some sedative such as oil of cloves, place a small amount of devitalizing paste over the area of exposure and very carefully seal in the paste with a plastic mix of zinc oxyphosphate cement. Forcing a stiff mix of cement into the cavity may force formalin into the pulp and immediately start a toothache. Toothache, in patients who are sensitive to formalin, may be stopped by a dose of 3 grains of

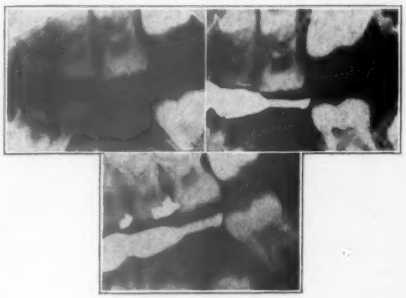

Fig. 9.—Case in child aged 5 years 8 months; Willett's technic, using double cast overlay and bar for space with no posterior abutment. Above, left, radiogram taken 2-20-36, showing space immediately after extraction, with first permanent molar unerupted; right, radiogram taken 3-31-36, showing space retainer in place. Below, radiogram taken 10-29-36, showing first permanent molar erupted.

acetyl salicylic acid, repeated in one hour if necessary. The patient is dismissed for two weeks.

The formula for the paste follows:

Paraformaldehyde	1.00 gm.
Procaine base	0.30 gm.
Powdered asbestos	0.50 gm.
Vaseline	1.25 gm.
Carmine to color.	

This amount of paraformaldehyde makes a 33 per cent mixture. The procaine base is used to reduce pulp irritation from the use of formalin and is selected in preference to the slower, acid-reacting hydrochloride. The addition of asbestos to the paste results in a consistency which makes it easy to handle. The vaseline serves as a vehicle. Paraformaldehyde is a polymerized formaldehyde which gives off formalin slowly at body temperature or in the presence of moisture. As a devitalizing agent, formalin is an entirely safe substance to be sealed in for a long period.

Two weeks later, the tooth is isolated (cotton rolls in a holder are sufficient when one works with an assistant);

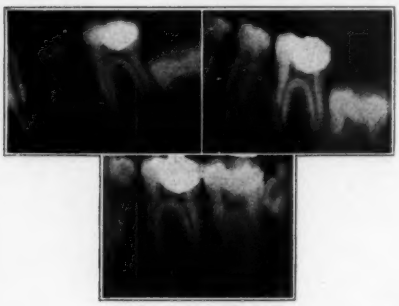

Fig. 10.—Case in child aged 10 years. Ammoniacal silver solution was reduced on the stained, but hard dentin over a nearly exposed pulp of a young first molar. Above, left, radiogram taken 3-3-32. The films taken 1-18-33 (above, right) and 5-8-35 (below) show the secondary calcification that followed.

carefully sterilized instruments are selected, and the tooth is painted with an antiseptic. The occlusal portion of the crown is opened wide with a cross-cut fissure bur; the cement and paste are removed, and a large round bur is revolved around the pulp chamber floor. The pulp tissue should appear gray and leathery, it should not bleed and it should be entirely devoid of sensation. If such a condition is not found, the paste is sealed on for another week.

All débris is cleaned out of the pulp chamber, without any attempt to enter the root canals; the pulp chamber is dried, and a mixture of the following pulp paste is made:

One capsule of root sealer powder (formula of U. G. Rickert)
Silver .....24.74 per cent
Zinc oxide .....34.00 per cent
Thymol iodide .....10.55 per cent
Oleoresins .....30.72 per cent
One drop of glycerin-iodine liquid.
Glycerin .....1 ounce
Iodine crystals .....8-10 grains
Warm or hot water bath until solution

Any root-canal paste that an operator

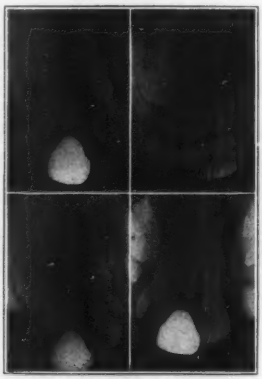

Fig. 11.—Case in child aged 8 years; continued calcification of a central incisor root after fracture of the crown, in which the pulp was not exposed, and restoration by a cast three-quarter clasp crown. Right, above, radiogram taken 4-19-33; below, 4-22-33. Left, above, radiogram taken 3-8-34; below, 5-6-35.

is accustomed to use will serve. The paste is pushed into the cleaned pulp chamber by a plastic instrument and then placed on the pulp chamber floor over the severed stumps of tissue in the canals with a piece of warm baseplate guttapercha. The gutta-percha is burnished smooth with a smooth hot instrument, a cement base is placed and a silver amalgam filling is packed on at once.

The operating time at the second appointment, if one works with an assistant, should not be more than forty-five minutes and will usually be thirty minutes. The addition of another fifteen minutes to seal in the paste placed at the previous appointment will make a total of forty-five to sixty minutes for a devitalization, pulpotomy and placing pulp paste, a cement base and a two-surface silver amalgam filling. The expenditure of this amount of time does not create a difficult fee problem.

More than 100 of these treated teeth have been followed since 1931 with check-up radiograms. Rarely does one show clinical or radiographic evidence of infection, and root resorption and exfoliation time have appeared to be normal. (Figs. 5-6.)

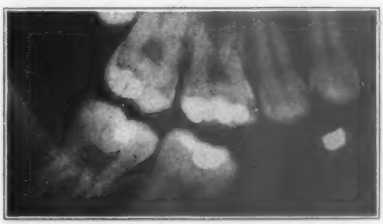

Fig. 12.—Case in youth aged 17. The patient had lost a second bicuspid and first molar. The remaining molars of the two jaws are in traumatic occlusion, the upper second bicuspid is elongating and resorption of the bony crest about the lower second molar has begun.

Acute Abscesses and Putrescent Deciduous Teeth.—The next step in pulp involvement to be managed, as treatment of a deciduous tooth is delayed, is an acute abscess. If such a tooth will drain promptly when it has been opened, it can be treated in a few days as in any other putrescent tooth condition which has subsided after its early acute stage. For those teeth with acute abscesses which do not drain promptly after they are opened, the most sensible treatment is extraction.

Putrescent teeth may be classified into two types on the basis of their response to treatment. Deciduous teeth will be found that drain through the cavity in the crown of the tooth and respond readily to drug therapy. Another group will be found in which drainage has been established through a fistula, a group that may be treated with difficulty.

It has seemed rational to use two, three or more drugs in the treatment of putrescent canals since there is a variation in the germicidal activity of each drug to different strains of organisms. The drugs which have been most frequently employed are formocresol, azochloramide, merthiolate and compound solution of iodine (Lugol's). Dissatisfied with former empiric methods of treatment, we have treated putrescent deciduous teeth this past year until we have secured at least one negative culture. Canals have been filled by working the

Fig. 13.—Extracted young permanent molars. The problem of open root ends confronts the operator who desires to do root canal work.

root paste down the canals with a file and applying pressure to an excess of paste in the pulp chamber with a plunger of warmed gutta-percha.

The putrescent deciduous teeth, which are draining through the patient's gums, respond to drug treatment in very few cases, particularly if the radiogram shows a large area of bone destruction between the bifurcated roots. Sweet's[6] rosehead bur treatment has been employed in some instances to preserve such deciduous teeth when they are second molars that became infected before the first permanent molars had erupted.

A study was recently completed of a deciduous incisor which had developed

an acute abscess after a fall by a patient 2 years and 10 months old. This tooth had been treated by azochloramide until whole blood had been noted on the dressings. One follow-up treatment had been made of formocresol and the root canal had been filled without being cultured. A radiographic check-up one and one-half years later revealed a rapid resorption of the root end and an enlarged resorption area about it. The question arose, "Is this normal but early resorption that has been caused about a treated, pulpless tooth, or is it resorption due to infection?" The root-canal filling was removed and two cultures of the root-end tissue produced pure growths of *Staphylococcus albus.* More radiographic

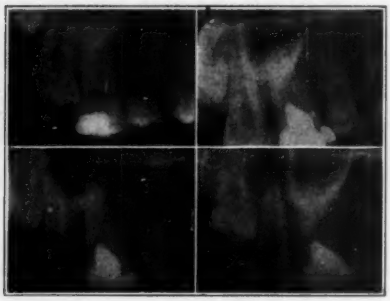

Fig. 14.—Case in child of 11 years; pulpotomy of vital permanent molar in which amputation was carried out under local anesthesia. Twice during the checking up period, the tooth was opened and all three canals were found vital. Above, left, radiogram taken 1-5-31; right, 8-28-33. Below, left, radiogram taken 2-1-35; right, 4-27-36.

and bacteriologic studies of treated putrescent deciduous teeth would seem to be indicated before our current management can be considered rational and scientific. (Fig. 7.)

Postextraction Management. — When the final decision for the treatment of an infected deciduous tooth is extraction, one may be confronted by a space maintenance problem. Extreme youth, loss of a second deciduous molar in advance of the eruption time of the first permanent molar and lessening of a space as determined by regular measurements are all indications for the preparation of a space maintainer. For the spaces with a posterior abutment, experience has led us to favor a modified type of Willett's[6] cast overlay space retainer. Our modification permits unrestricted lateral growth in the cuspid region. (Fig. 8.) Willett's double cast overlay and posterior bar are used to replace the second deciduous molar that is lost prior to the eruption of the first permanent molar. (Fig. 9.)

PULP MANAGEMENT FOR YOUNG PERMANENT TEETH

When an operator works on children

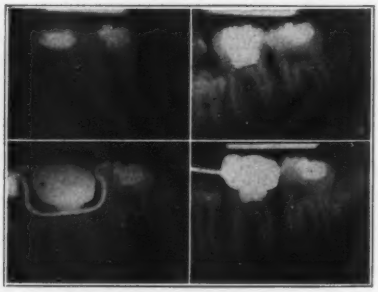

Fig. 15.—Case in child aged 12 years. A molar had been banded and used as a fulcrum for orthodontic work in order to secure eruption of the second bicuspid. Above, left, radiogram taken 3-7-33; right, 4-5-33. Below, left, radiogram taken 3-9-34; right, 1-8-35.

who have not been periodically recalled, he is constantly being confronted by pulp management cases in young permanent teeth. Frequently, these cases will be encountered before the root ends of the teeth that are involved are completely calcified. The pulps of many young first permanent molars are exposed by caries and a number of young incisor teeth are fractured accidentally. The young permanent teeth present their own special problems. Near exposure, vital exposure

and putrescence have to be managed.

Near Exposure.—All operators see young first permanent molars from which they excavate layer after layer of leathery dentin until they find brown dentin that appears comparatively firm, the last barrier between the invasion of caries and an exposed pulp. The question arises: Should these teeth be filled, should the pulp be capped, should the pulp be removed or should the tooth be extracted? This question applies to both posterior and anterior teeth.

It has been our routine practice for several years to reduce a fresh solution of ammoniacal silver solution on the layer of thin brown dentin. Eugenol serves as the reducing agent. The tooth is dried after the application of eugenol and painted with a varnish consisting of a saturated solution of Canada balsam in oil of cloves. Zinc oxide cement powder —a large spoon excavator full—is dropped into the tooth and allowed to adhere to the varnished walls of the cavity. This provides a dry layer to intercept the phosphoric acid from the cement base, which is placed next. A thin plastic mix of zinc cement is first inserted and a heavy doughy mix is used to finish the cement base. A silver amalgam filling is placed at once.

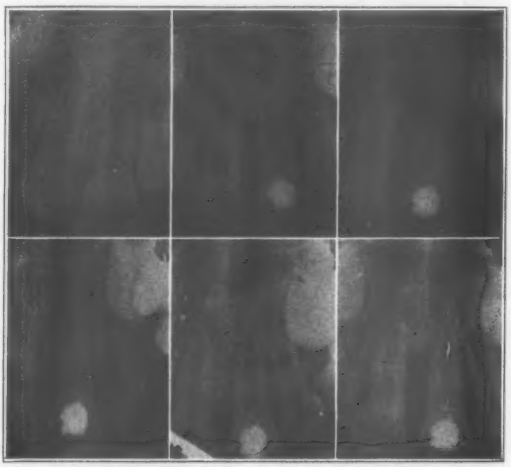

Fig. 16.—Case in child aged 9 years; nine months' calcification of fractured vital central incisor on which pulpotomy was performed. Above, left to right, radiograms taken 2-9-37, 2-9-37, 3-27-37. Below, left to right, radiograms taken 6-12-37, 9-15-37, 11-6-37.

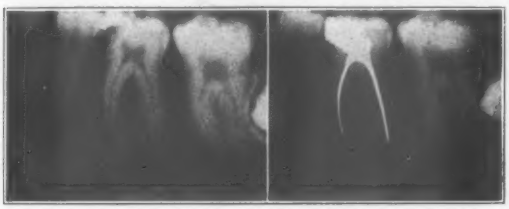

Fig. 17.—Two molars the root canals of which have been filled with silver canal points, in youth aged 15.

Considerable criticism has been offered from time to time of the use of silver

nitrate solution so near a vital pulp. Attention must be called to the fact that the ammoniacal solution is alkaline and is reduced by eugenol, not formalin. Prime[7] has been advocating the same silver reduction with a cement filling for a time, until secondary calcification occurs in the dentin. Later, the stained dentin is removed, before a permanent filling is placed. Radiographic checkups of the treated teeth have shown a generous calcific deposition on the pulpal side of the dentin. (Fig. 10.)

Many of the near exposures in young anterior teeth are caused by fractures. We have taken a radiogram as soon as we could see the patient, and bathed the fracture area generously with phenol, varnished it and covered it with a celluloid crown form which has been filled with zinc oxide and eugenol. The tooth has been given a rest period of ten days to two weeks and a permanent restoration has been prepared. Our most frequent choice of prosthesis has been a cast, three-quarter, clasp-onlay crown with a silicate cement window. (Fig. 11.)

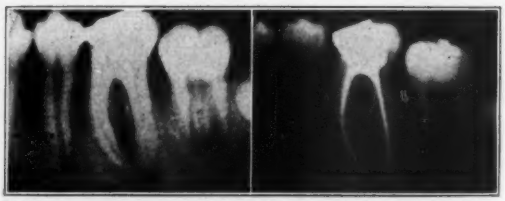

Fig. 18.—Case in child aged 13 years. (Compare Fig. 17.)

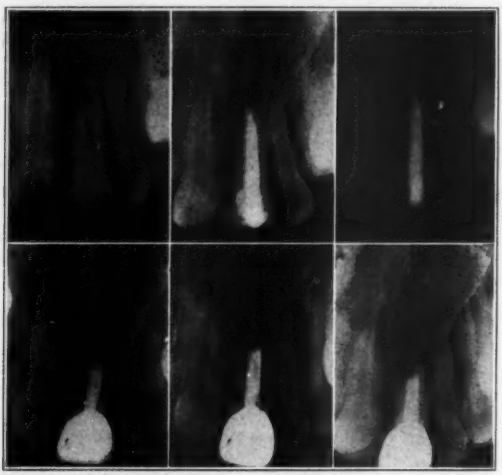

Fig. 19.—Case in child of 9 years; putrescent fractured incisor with uncalcified root end that was treated, filled with paste and a large guttapercha point, retreated and filled and the root resected. Above, left to right, radiograms taken 4-27-32, 5-25-32 (after first filling), 3-6-33 (enlarged resorption area about root tip). Below, left, radiogram taken 4-6-33 (root refilled and resected); right, 3-13-34 (check-up one year after resection showing new dense calcification around root tip).

Vital Exposed Pulps.—The dictum of

many serious students of the practice of orthodontics concerning the management of pulp-involved first permanent molars, is "Save these first permanent molars, if possible, as long as possible." Orthodontists point out the unsatisfactory results of promiscuous extraction in young patients, which vary from a slight gingival irritation and interference in function to a crippled dentition. In so many young adult patients' mouths, drifted molars, traumatic molar occlusion, incipient pyorrheal pockets, extruded unopposed teeth and a closed anterior relation with a gingivitis about all of the incisors are found that a children's operator who is considerate of future occlusion begins to search for a technic to preserve the first permanent molar. (Fig. 12.)

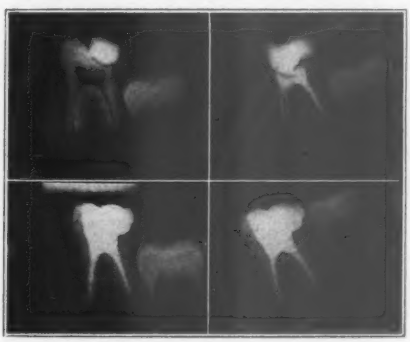

Fig. 20.—Case in child aged 9 years; calcification completed around root ends of first permanent molar that has been filled by gutta-percha points. Above, left, radiogram taken 7-23-34; right, 8-8-34. Below, left, radiogram taken 1-26-35; right, 4-24-37.

Our operative treatment since 1931 has been a vital pulpotomy of the young permanent teeth with exposed pulps. This procedure must be considered experimental, since some teeth have been found to respond to this treatment very nicely, whereas others have degenerated. The management problem which uncalcified root ends present determined our choice of treatment. (Fig. 13.) Without an accurate clinical record, we have the impression that in 50 per cent of all of the experimental pulpotomies performed on permanent teeth in young and old patients, reaction has been favorable for several years. In young patients, the teeth with vital exposed pulps, but with no history of toothache, which have been selected for our experiments, have reacted very favorably indeed. The older the patient, the less favorable the prognosis.

After leathery dentin has been removed from the cavity and exposure is detected, oil of cloves or some similar sedative is sealed under cement for at least twenty-four hours. Oil of cloves partially sterilizes the cavity and serves to reduce pulp hyperemia. It is difficult to anesthetize a hyperemic pulp deeply.

The tooth is anesthetized at the second appointment. If possible, nerve blocking is combined with peridental infiltration. A rubber dam is placed, the tooth is sterilized, sterile instruments are selected and the occlusal portion of the pulp chamber is cut wide open. The entire coronal portion of the pulp is then amputated by a few revolutions of a large round bur. The entrance to each canal is touched by a small round bur, and each amputated canal pulp stump is touched by a red hot root canal pick to cauterize it. The pulp chamber is cleaned with hydrogen peroxide, washed with saline solution and dried. The same pulp paste is introduced in the same manner as has been outlined for a deciduous tooth pulpotomy. (Figs. 14-16.)

Silver Point Filling.—If a tooth with patent foramina can be kept vital until these foramina calcify, our purpose can be considered accomplished. A filling can then be placed that consists of paste and silver points. The silver point technic has taken much of the difficulty out of filling the root-canals of a multirooted tooth. For that reason, the silver point technic is recommended. (Figs. 17-18.)

Putrescent Permanent Teeth.—Once a young permanent tooth becomes putrescent, the procedure of choice is extraction or a long continued treatment by drugs followed with a sectional gutta-percha point filling. If drug treatment is the choice, treatment is carried out until two successive negative cultures are obtained. Large involved areas clear up in a surprising manner about the roots of young patients' posterior teeth. The anterior teeth can always be managed by a root-canal filling and root resection. Large gutta-percha points are selected for the canals with open root ends. The points are pushed to a point which, according to the operator's measurements, is just short of the root ends, and a radiogram is taken and immediately developed. Correction is then made by adjusting a rubber marker on each root-canal plugger, which will permit the plugger to force the points exactly to the root ends. Periodic radiograms taken after such gutta-percha point fillings have shown a further calcification about the treated root ends. (Figs. 19-20.)

SUMMARY AND CONCLUSIONS

An attempt has been made to review the various pulp conditions which demand treatment in a children's practice. This review lists progressively worse conditions, as they arise from delayed treatment, for both the deciduous and the permanent dentition. A preventive operative program, begun early and continued regularly, is recommended as the best pulp treatment for both dentitions.

For the deciduous teeth, the following treatment suggestions are made:

1. Ammoniacal silver reduction and a shallow zinc oxyphosphate cement lining for all deep cavities.

2. Devitalization by paraformaldehyde and a pulpotomy for all vital exposed pulps.

3. Treatment of selected putrescent teeth by a variety of drugs, until negative by culture, and a root paste filling.

4. A modification of the Willett cast overlay space retainers, where indicated, for postextraction treatment after early loss.

The suggestions for the management of pulp conditions which arise in young permanent teeth are likewise listed:

1. A combination of ammoniacal silver reduction, varnish, zinc oxide, cement base and immediate filling for the nearly exposed pulps of first permanent molars.

2. A vital pulpotomy under local anesthesia for the exposed pulps of both anterior and posterior teeth with uncalcified root ends.

3. The silver point root-canal filling technic for pulp exposure in vital posterior teeth with completed root ends.

4. A sectional gutta-percha point filling for treated putrescent posterior teeth with patent foramina and a similar filling for similar anterior teeth, with the choice of root resection where indicated.

BIBLIOGRAPHY

1. Chaneles, J.: Estudio Experimental de la Accion de Algunos Medicamentes Sobre la Pulpa Humana (I) El Oxido de Cinc-Eugenol. Professor's thesis from the School of Dentistry, Buenos Aires, 1933. (Translated by A. J. Logan.)

2. Rosenstein, S. N.: Studies in Conservation of Deciduous and Early Permanent Teeth. *J. D. Res.*, 16:29-31, February 1937.

3. Gurley, W. B., and Van Huysen, Grant: Histologic Changes in Teeth Due to Plastic Filling Materials. J.A.D.A., 24:1806-1816, November 1937.

4. Gerlach, Elsie: Root Canal Therapeutics in Deciduous Teeth. *D. Survey*, 8: 68-74, May 1932.

5. Sweet, C. A.: Procedure for Treatment of Exposed and Pulpless Deciduous Teeth. J.A.D.A., 17:1150-1153, June 1930.

6. Willett, R. C.: Intercepting Certain Types of Malocclusion. J.A.D.A., 16:389-404, March 1929.

7. Prime, J. M.: Further Extending Use of Howe's Ammoniacal Silver Nitrate in Control of Dental Caries. *D. Cosmos*, 77:1046-1059, November 1935.

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THE PASSING OF THE DENTAL COSMOS

WITH the publication of the December, 1938, issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION AND THE DENTAL COSMOS, the name Dental Cosmos ceases its association with the periodical literature of dentistry. Thus will pass into the history of dentistry a record of accomplishment in the dental literary field that is unique indeed.

Entering the dental periodical field, as the Dental News Letter, in 1846, at a period when it was evident that independent, profession-owned periodical literature could not receive sufficient support from the individual members of the profession to maintain it as an independent institution, this first subsidized effort continued its career until 1859, when it became the Dental Cosmos. With a new name and with a new orientation to its aims and objectives this new magazine signalized a pioneering venture in dental literature that was in the years to come to establish a record conspicuously outstanding and notable.

How well the aims, purposes and ambitions of the Dental Cosmos, as announced in its first issue, have been attained and fulfilled remains as a heritage in the ninety-two volumes of the combined publications.

Conceived and fostered in the mind of Dr. James W. White, who later became its editor, the Dental Cosmos from its origination assumed a position in the dental educational field that definitely reflected the serious interest in the welfare of dentistry by one whose ambitions and actions did much to establish dentistry on a foundation upon which was to be builded an autonomous profession that was to attain distinction in the professional field.

The volumes of the Dental Cosmos, in conformity with the unanimous ambitions of its various succeeding editors that it observe, reflect, compare and record all that should be preserved in the dental literary archives, comprise a record of the history of dentistry.

Under the direction of pioneers in the dental profession imbued with ideals and ambitions for a specialty of the healing art that would rival in degree its parent, the founders of the Dental Cosmos and their successors fulfilled an obligation and debt to dentistry in a manner that was a constant source of inspiration to all who later entered its ranks.

In the early days of the Dental Cosmos, the educational and professional trend of dentistry was definitely toward the development of the more technical aspects of practice as therapeutic means of restoration of teeth ravaged by disease. The fact that dentistry was thrown upon its own resources and the emphasis that had been laid upon high technical skill as an operative measure, practically compelled its development from the purely mechanical aspect. Further emphasized by an appreciation of the esthetic, dental practice tended even more definitely to the technical; so much so, that in its early days dentistry was almost diverted into a mechanical trade. There was, however, a dormant appreciation of the possibilities of development along more scientific lines as a part of the great healing art, and there arose contention between two distinct groups which advocated the practical on the one hand and the scientific on the other.

The leaning of the editorial influence of the Dental Cosmos was ever toward the scientific. And in the days when the influence and work of men like Miller, Black and Williams were being exerted toward the development of dentistry from the scientific angle, the Dental Cosmos opened its pages to the publication and promotion of the scientific efforts of these pioneers of the newer conception of practice, and often at the expense of severe criticism from the rank and file of dentistry.

When the now noted work of Miller, "The Human Mouth as a Focus of Infection," was published in the eighties, there was practically a wave

of protest against the scientific and the impractical efforts to divert dentistry from its trend toward technical perfection. The then editor of the Dental Cosmos was severely criticized for devoting so much space to what was designated by some as "ultra-scientific, high-brow and impractical" material, but we are of the belief that the wide and persistent publicity given to the scientific efforts of Miller, Black and Williams marked the turning point of dental development and definitely committed dentistry to the course of development along scientific rather than along so-called mechanical lines.

For practically the first time an opportunity was afforded to the Dental Cosmos to declare itself unequivocably for the "scientific" as the most "practical" aspect from which to develop dentistry as custodian of an important organ of the human body that must be approached from the biologic point of view as a part, and necessary part, of the human body, and one that constituted a source of disease and health to the body as a whole.

While the approach to dentistry today is almost universally from the vital or biologic point of view, there is still considerable of the thought of the practical vs. the scientific left. There are still those who emphasize the greater importance of technical skill in dental practice—and technical skill is highly and essentially necessary to complete dental practice, but the trend educationally and professionally is definitely biologic.

That period in the evolution of dentistry proved to be the most crucial in its career as determining the future course of development of dentistry, and it was the clear thinking and idealism of the leaders in dental periodical literature that steered the profession over the shoals of mechanics in the educational stream, and directed us to what we now recognize as the only logical, humanitarian and professional development of dental practice.

With the realization of its biologic relation to the other branches of the healing art, there came the desire to divorce the literature of the profession from its commercial affiliations, as it appeared inconsistent with the new idealism of dentistry. Many of the so-called commercial journals readily acceded to the view, and finally in 1936, the Dental Cosmos, sensing the modern trend of journalistic idealism, consented to the merging of the Dental Cosmos with THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. This appeared to be the happy and logical diversion of the most noted proprietary journalistic effort, but the momentum gained by the desire to absolutely control its literature eventuated in a persistent

and unceasing effort on the part of the profession toward the absolute divorce of proprietary and professional efforts that seemed to make it expedient to eliminate the Dental Cosmos entirely from the literary field.

THE GREATER NEW YORK DENTAL MEETING, 1938

THE Greater New York Dental Meeting, the Fourteenth Annual Session of which was held in the Pennsylvania Hotel, New York City, December 5 to 9, 1938, has become an established dental educational institution. Here each year some forty-two educational clinics covering every phase of dentistry, in one and two hour clinic sessions, are given to those members of the district societies and guests who register for the courses.

The organization, made up of the combined membership of the First and Second District Societies of the State of New York, has promoted and perfected this method of supplementary dental education over a period of some fourteen years, and there are thousands of dentists each year who take advantage of this very unusual opportunity to keep abreast of the latest advances in dental practice.

The instructors are selected from among the leaders in every section of the country and the scope of the instruction covers every phase of dental practice in a manner calculated to meet the needs of the modern dental practice. These clinics embrace practically every phase of dentistry—exodontia; treatment of periodontal lesions; denture prosthesis; balanced occlusion; immediate denture service; amalgam restorations; children's dentistry; electro-coagulation; oral surgery; gold foil operations; anesthesia and analgesia; porcelain work; silicate restorations; radiographic diagnosis; pulp-canal therapy; bridgework and local anesthesia—presenting the latest knowledge in all subjects and constituting virtually a postgraduate course in dentistry.

The manufacturers' exhibits demanded more space this year because of the growing popularity of this meeting, and practically four large meeting halls were given over to this phase of the meeting.

On the opening day of the meeting the entire time was devoted to the sessions of the combined Medico-Dental meeting—a feature of this annual meeting that is attracting more and more attention as the years pass. Under the sponsorship of a joint committee of the Organized Medical and Dental Professions of Greater New York, intensive atten-

tion is devoted to developing closer cooperative efforts between the medical and dental professions of Greater New York. Under the guiding hands of Dr. M. O. Magid, representing the medical group, and Dr. Orville S. Long, representing the dental group, much has been accomplished in bringing about a better appreciation and understanding of the problems in which both are vitally interested. This year much attention was given to the blood dyscrasias which involve both dental and medical efforts.

The registration this year was somewhat less than last, but was still close to the record mark established last year.

On the last day a large clinic was opened to all and the interest manifested indicated a continuing desire for this type of clinic.

Another feature of the meeting which attracted more attention this year and which is an increasingly popular feature of the meeting, was the Topic Discussions, at which, under capable direction, special topics of daily practice were discussed in some twelve groups.

In a year in which dental practice is still suffering from the aftermath of depression, it is encouraging to note the eagerness with which dentists are improving their time against the day when all expect to be busily engaged in meeting the cumulative needs of several years of dental neglect.

All in all, the Greater New York meeting, under the capable direction this year of Chairman Dr. Charles M. McNeely, and Advisory Chairman Dr. Waldo H. Mork, ably assisted by Dr. Percy T. Phillips, Vice-Chairman, and Dr. Walter A. Quinn, Secretary-Treasurer, has established itself as one of the leading educational institutions in dentistry in this country.

OUR NEW COVER

WITH this issue we are pleased to present to our readers a new cover, designed to meet an insistent demand for a more modern dress for THE JOURNAL. The discontinuance of "The Dental Cosmos" in the title seemed to offer an appropriate time and opportunity for such a change, and we trust it will meet with the approval of all of our readers.

OBITUARY

ALBERT W. CROSBY

(1870-1938)

In the passing of Albert William Crosby, D.D.S., of New Haven, Conn. on Friday, November 11, 1938, the profession of dentistry in Connecticut suffered the loss of one of its leading practitioners. Taken ill during January with an attack of pneumonia, Dr. Crosby recovered sufficiently to resume the practice of orthodontia in the Spring, and went abroad in the early summer to further regain his health. However, he was confined to his home virtually from the time of his return in early September until a heart attack proved fatal.

Born in Hartford, Conn., November 13, 1870, the son of William Andrews and Alice Isola (Rodda) Crosby, Dr. Crosby was a descendant of Simon Crosby, who settled in Cambridge, Mass., in 1636, and of John Andrews, one of the original founders in 1658 of Farmington, Conn. He received his early education in the public schools of his native city, and was graduated from the New York College of Dentistry in 1892, later attending the Angle School of Orthodontia and taking, as well, special courses of study at the Yale University School of Medicine; the New York Post-Graduate Medical School and Hospital and the Manhattan Eye, Ear and Throat Hospital. After graduation, Dr. Crosby opened his office in New London, Conn., where he practiced until 1911. Since that time, he had lived in New Haven, where he practiced his specialty of orthodontia.

Surviving is the widow, Isabel Seldon Darrow, whom he married in 1900.

The extremely wide range of "Bert" Crosby's interests is evident when one observes his affiliations. Memberships included the New Haven and New London County Dental associations and Connecticut State Dental Association, in all three of which he had been president. He served in a similar capacity in the Eastern Association of Graduates of the Angle School of Orthodontia, the Horace Wells Club and the American Board of Orthodontia. He was the first Grand Master of the Connecticut Auxiliary of the Delta Sigma Delta Fraternity and was elected Junior Page of the Supreme Chapter in St. Louis. He was a Trustee of the American Dental Association from 1931 to 1934. He also was a member of the New England Dental Society; the International Society of Dental Research (Chairman of the Yale Unit), the New York Academy of Dentistry, First European Orthodontological Society, New York Society of Orthodontists and the American Association for the Advancement of Science. Dr. Crosby was a member of Omicron Kappa Upsilon and a Fellow of the International College of Dentists and he had served on the Connecticut State Dental Commission. During the World War, he was chairman of the Connecticut Unit of the Preparedness League of American Dentists.

Dr. Crosby had been Master of Brainard Lodge No. 102 A.F. and A.M., and being a 32nd degree Mason, held many other high chairs in this order. A member of the New London Board of Education, Dr. Crosby continued his interest when he moved to New Haven, and served on many advisory committees for the latter city.

As associate clinical professor of dental surgery at the School of Medicine, Yale University, and attending orthodon-

tist at New York University, he lectured at both institutions on his specialty. He also wrote many articles for various dental journals. He was a member of the Chamber of Commerce, Quinnipiac Club, Yale Alumni Association, the Faculty Club, Lawn Club and Rotary Club of New Haven and the Thames Club of New London.

He was a founder and one of the first presidents of the New Haven Collectors Club. His collection of "horse brasses" (martingale decorations) numbered several hundred and is one of the outstanding collections of its nature in this country. It was obtained in many lands. Among the most highly prized were some dating back to the days of the Crusaders; as were some special designs commemorative of the coronations of many English monarchs. Another of Dr. Crosby's deepest interests in recent years was the Dental Clinic Society of New Haven, of which he was a founder and had been

ALBERT W. CROSBY, D.D.S.
(1870-1938)

vice-president since its beginning. This philanthropic organization gave Dr. Crosby an opportunity for a continual expression of his nature.

All the honors which were showered on Albert Crosby were received with uncommon modesty. No false sense of values was his, and never was he known to make his personal ambitions audible. Generous, patient and tolerant of the opinions of others, he always held out a helping hand to the young practitioner. Integrity was the keystone of his many virtues, and no one would ask his advice and fail to benefit therefrom. He was an indefatigable worker and his colleagues among the Trustees of the American Dental Association learned to value his opinions highly.

The following expressive minute was adopted by the Connecticut Auxiliary of the Delta Sigma Delta fraternity:

Met tonight in annual fall session, when trees are stripped of their verdant foliage and draped in somberness, brothers in Delta Sigma Delta are sad in mind and heart because of the absence of him whose place no one can fill.

Often is this said when one departs into his eternal rest, but on this occasion it is the encompassing truth.

Albert Crosby, by all his deeds, personified the loftiest ideals of our fraternity. His life was indeed one which all of us may well strive to emulate. To have known him was a privilege.

Words are futile, but immortality is Albert Crosby's.

MORTON J. LOEB.

BIBLIOGRAPHICAL

A Textbook of Histology

By ALEXANDER A. MAXIMOW, Late Professor of Anatomy, University of Chicago, and WILLIAM BLOOM, Associate Professor of Anatomy, University of Chicago. Third Edition; completely revised. 668 pages with 542 illustrations, some in colors. Philadelphia and London: W. B. Saunders Company, 1938. Cloth, $7.

The textbook of histology of Maximow and Bloom needs no introduction. In less than a decade, it has established itself as one of the leading texts for teaching and reference. The fundamentals are clearly stated and beautifully illustrated. Contrary to the old-time type of histology book, which was confined to stereotyped descriptions of the microscopic appearance of cells and tissues, the new Maximow-Bloom book contains many additional discussions of the normal and pathologic physiology of the body tissues. Under the heading "Histophysiologic Remarks," function and clinical correlations are considered and illustrated. The chapter on the teeth is brief, but contains essential and up-to-date information. The chapters on epithelium, connective tissue and bone should be consulted by any dentist who wishes to familiarize himself with the fundamentals of the most important oral tissues.

RUDOLF KRONFELD.

Textbook of Periodontia

By SAMUEL CHARLES MILLER, D.D.S., associate professor of periodontia in charge of the Periodontia Department, New York University College of Dentistry; Lieutenant, Dental Corps, United States Naval Reserve (Special Service); and members of the Periodontia Staff of New York University, College of Dentistry.

The author makes an excellent statement in the preface to the text in which he says that "only through sound knowledge of the diseased processes involved and the utilization of efficient methods for their treatment can the dentist achieve the highest goal in oral health service."

The subject matter covers a broad field and the book is well illustrated. The bibliog-

raphy reviewed and reference reading recommended is extensive and will be a great help to any student or research worker.

Many references are made to the writings of Box and frequent references are also made to the work of Gottlieb and Orban. The technical procedure of instrumentation is well illustrated and discussed.

The chapter on habit as an etiologic factor is illuminating, emphasizing the importance of local factors in the etiology of periodontal disease. The chapter on biochemistry by the author and the chapter on the endocrine system by Felix Boenheim are deeply interesting. There is doubtless much in these studies that is closely related to periodontal disease and the authors are to be complimented for their effort to show this relationship.

The author's use of the word "serumnal" will meet with objection since it is not found in the medical and dental dictionaries. The words "serumnal calculus" are substituted for "serumal calculus." The term "subgingival calculus" is now in common use.

The book is a valuable contribution and will be useful to dental teachers and to students of periodontia.

Books Received

The Surgery of Oral and Facial Diseases and Malformations: Their Diagnosis and Treatment Including Plastic Surgical Reconstruction

By George Van Ingen Brown, D.D.S., M.D., C.M., F.A.C.S., Emeritus Professor of Plastic Surgery, University of Wisconsin. Sometime Professor of Oral Surgery and Oral Pathology, State University of Iowa, and Special Lecturer on Oral Surgery, University of Illinois, Vanderbilt University and Atlanta-Southern Dental College. Plastic Surgeon, Children's, St. Mary's, Columbia and Milwaukee County Hospitals, Milwaukee, Wis. and State of Wisconsin General Hospital, and Wisconsin Orthopedic Hospital for Children, Madison, Wis., Consulting Plastic Surgeon, Methodist Hospital, Madison, Wis., Consulting Maxillo Facial Surgeon, Veterans' Administration Facility, Wood, Wis. Colonel, Inactive, in the Army of the United States. Fourth Edition. Thoroughly Revised. With 589 Engravings, containing 1019 illustrations and 12 colored plates. Philadelphia: Lea & Febiger. 1938. Price $10.

Practical Microscopy of the Teeth and Associated Parts

A Handbook for Students, Research Workers and Practitioners. By A. W. Wellings, M.D.S.B'ham, L.D.S.Edin., Lecturer in Histology and Pathology of the Teeth and Associated Parts in the University of Birmingham; John Tomes Prizeman of the Royal College of Surgeons of England; External Examiner in Dental Surgery in the Victoria University of Manchester, 1925-1927, 1931-1933. London: John Bale, Sons & Curnow, Ltd. 1938. Price 12/6 net.

Biology and Pathology of the Tooth and Its Supporting Mechanism

By Bernhard Gottlieb, Research Professor, Columbia University Dental School, Formerly Professor in the University of Vienna Dental School.

Balint Orban, Assistant Professor, Northwestern University Dental School Chicago; formerly Professor in the University of Vienna Dental School.

Translated and edited by Moses Diamond, Associate Professor, Columbia University Dental School, New York, Head of Dental Anatomy Department. New York: The Macmillan Company. 1938. Price $5.

Conduction, Infiltration and General Anesthesia in Dentistry

By Mendel Nevin, D.D.S., former Oral Surgeon, Greenpoint Hospital; former Oral Surgeon, Hospital for Deformities and Joint Diseases.

P. G. Puterbaugh, M.D., D.D.S., Professor of Principles of Medicine and Anesthetics and Associate Professor of Oral Surgery, Chicago College of Dental Surgery; Ex-President and Life Member of the Illinois State Dental Society; President of the Odontological Society of Chicago. Collaborators: Fred R. Adams, D.D.S., F.I.C.D., Hillard R. Nevin, L.D.S., D.D.S. Fourth Edition. Illustrated with 213 engravings and large trigeminal nerve chart. Brooklyn, N. Y.: Dental Items of Interest Publishing Co., Inc. London: Henry Kimpton. 1938.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Dentifrices*

Allen's Tooth Powder: Composition: See Graver's Tooth Powder (A.D.R. 1938, p. 115).

Manufactured by C. J. Graver & Co., Cleveland, Ohio. Distributed by The K-W Drug Company, Cleveland, Ohio. No U. S. patent or trademark.

"That's Mine" (Brand) Children's Dental Cream: Composition: Each hundred grams is said to contain tricalcium phosphate (Victor), 58.5 gm.; hard soap, 4.25 gm.; glycerite of starch, 34.5 gm.; soluble saccharin, 2 gm.; gum tragacanth, 0.75 gm.; flavoring (wintergreen, spearmint, peppermint, clove), 2 cc., and coloring (U. S. approved), q.s.

ABRASIVENESS: 0.1 mg. in 2,000 revolutions on the Victor machine.

Manufactured by "That's Mine" Children's Dental Cream Company, Ithaca, Mich.

Local Anesthetics†

Procaine Solution 2% with Epinephrine 1:50,000-Jefferson Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine HCl, 0.00002 gm.; disodium phosphate, 0.003 gm.; sodium chloride, 0.0026 gm.; sodium bisulfite, 0.0015 gm., and distilled water.

Manufactured by K. Reisman, Philadelphia, Pa. Distributed by Jefferson Laboratories, Philadelphia, Pa. No U. S. patent or trademark.

Procaine Solution 2% with Epinephrin 1:50,000-Jefferson Brand in Cartridges, 2.5 cc. approximately.

Procaine Solution 2% with Epinephrine 1:25,000-Jefferson Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine HCl, 0.00004 gm.; disodium phosphate, 0.003 gm.; sodium chloride, 0.0026 gm.; sodium bisulfite, 0.0015 gm., and distilled water.

Manufactured by K. Reisman, Philadelphia, Pa. Distributed by Jefferson Laboratories, Philadelphia, Pa. No U. S. patent or trademark.

Procaine Solution 2% with Epinephrine 1:25,000-Jefferson Brand in Cartridges, 2.5 cc. approximately.

Procaine Solution 2% with Neosynephrin 1:10,000-Jefferson Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; neosynephrin, 0.0001 gm.; disodium phosphate, 0.003 gm.; sodium chloride, 0.0026 gm.; sodium bisulfite, 0.0015 gm., and distilled water.

Manufactured by K. Reisman, Philadelphia, Pa. Distributed by Jefferson Laboratories, Philadelphia, Pa. No U. S. patent or trademark.

Procaine Solution 2% with Neosynephrin 1:10,000-Jefferson Brand in Cartridges, approximately 2.5 cc.

Procaine Solution 2% with Epinephrine 1:25,000-Standard Dental Products Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epineph-

*A.D.R. 1938, p. 112.
†A.D.R. 1938, p. 36.

rine, 0.00004 gm.; sodium bisulfite, 0.0015 gm.; sodium chloride, 0.0026 gm., and disodium phosphate, 0.003 gm., in distilled water.

Manufactured by K. Reisman, Philadelphia, Pa. Distributed by Standard Dental Products Co., Philadelphia, Pa. No U. S. patent. Trademark "Standard" U. S. No. 346071.

Procaine Solution 2% with Epinephrine 1:25,000 in Standard Tubes.

Procaine Solution 2% with Epinephrine 1:50,000-Standard Dental Products Brand: Each cubic centimeter is said to contain procaine hydrochloride, 0.02 gm.; epinephrine, 0.00002 gm.; sodium bisulfite, 0.0015 gm.; sodium chloride, 0.0026 gm.; disodium phosphate, 0.003 gm., in distilled water.

Manufactured by K. Reisman, Philadelphia, Pa. No U. S. patent. Trademark "Standard" U. S. No. 346071.

Procaine Solution 2% with Epinephrine 1:50,000 in Standard Tubes.

Calcium Compounds‡

Precipitated Calcium Carbonate, U.S.P.§

Precipitated Calcium Carbonate Extra Light, Light, Medium, Heavy and Extra Heavy-National Gypsum Company: Precipitated calcium carbonates-National Gypsum Company comply with U.S.P. XI (p. 96). They are used in the manufacture of dentifrices.

Manufactured by National Gypsum Company, Buffalo, N. Y.

CHEMICAL ANALYSIS: 98-98.51 per cent calcium carbonate.

PHYSICAL PROPERTIES:

PARTICLE SIZE: The particle size distribution determined according to a modification of the method of Perrot and Kinney (see A.D.R. 1938, p. 96) is said to have the following typical distribution:

	Diameter in Microns			
Grade No.	Less than 5	5 to 10	10 to 20	Maximum Size
Extra light	87%	12%	1%	16
Light	84%	13%	3%	18
Medium	86%	13%	1%	26
Heavy	77%	21%	2%	36
Extra heavy	75%	23%	2%	42

DENSITY:

Extra light	2.66
Light	2.66
Medium	2.67
Heavy	2.65
Extra heavy	2.65

ABRASIVENESS: The abrasiveness of precipitated calcium carbonates-National Gypsum Company was determined by rotating a polished surface of antimony in a slurry of chalk and water under a weight of 63 gm. for 6,480 revolutions on a test machine (details filed with the Council). The area of the metal specimens exposed was 53 sq. mm. and the Bierbaum hardness was 236 units for antimony.

Grade No.	Average Mg. Loss
Extra light	2.7
Light	2.9
Medium	3.2
Heavy	3.3
Extra heavy	3.6

J. Bird Moyer Products

The following products of the J. Bird Moyer Co., Inc., Philadelphia, Pa., are admitted to Accepted Dental Remedies. They will appear in the next edition of the book.

Aconite and Iodine, Moyer—A mixture of 50% tincture of aconite, U.S.P., and 50% tincture iodine, U.S.P., by volume.

Aromatic Sulfuric Acid, Moyer—A brand of aromatic sulfuric acid, U.S.P.

Chloroform and Resin, Moyer—A preparation containing

‡A.D.R. 1938, p. 89.
§A.D.R. 1938, p. 92.

60% chloroform, U.S.P., and 40% resin.

Chromic Acid, Crystals, Moyer—A brand of chromium trioxide, U.S.P.

Chromic Acid 10% Solution, Moyer — A solution of chromium trioxide, U.S.P., 10% by weight.

Eucalyptol, Moyer—A brand of eucalyptol, U.S.P.

Eugenol, Moyer—A brand of eugenol, U.S.P.

Formalin, Moyer—A brand of formaldehyde solution, U. S.P.

Iodine, U.S.P., Resublimed, Moyer—A brand of iodine, U.S.P.

Iodoform Paste (Aromatic), Moyer—A mixture of 30% iodoform, U.S.P., 31% zinc oxide, U.S.P., 37% petrolatum, U.S.P., and 2% oil cassia and cloves, U.S.P.

Monsel's Solution, Moyer—A brand of solution of ferric subsulfate, N.F.

Oil of Cassia, Moyer—A brand of oil of cinnamon, U.S.P.

Oil of Cloves, Moyer—A brand of oil of cloves, U. S.P.

Oil of Eucalyptus, Moyer—A brand of oil of eucalyptus, U.S.P.

Paraform (Paraformaldehyde), Moyer—A brand of paraformaldehyde or trioxymethylene in powder form. Formerly listed in U.S.P. X.

Phenol (Carbolic Acid) U.S. P. Crystals, Moyer — A brand of phenol, U.S.P.

Phenol Solution, 90%, Moyer —A brandof liquefied phenol U.S.P., containing 88% and more of pure phenol.

Phenolsulfonic Acid, Moyer—Approximately 90% solution of completely chemically combined phenol, U.S.P., and sulfuric acid, U.S.P., in the form of phenolsulfonic acid.

Silver Nitrate, 10% Solution, Moyer—A 10% solution of silver nitrate, U.S.P.

Sulfuric Acid, 50% Solution, Moyer—A 50% solution of sulfuric acid, U.S.P.

Tannic Acid (Tannin), U.S. P. Powder, Moyer — A brand of tannic acid, U.S.P.

Thymol, U.S.P. Crystals, Moyer—A brand of thymol, U.S.P.

Tincture of Aconite, Moyer—A brand of tincture of aconite, U.S.P.

Tincture of Iodine, Moyer—A brand of tincture of iodine, U.S.P.

Trichloracetic Acid, U.S.P., Crystals, Moyer—A brand of trichloracetic acid, U.S.P.

Trichloracetic Acid, 90% Solution, Moyer—A 90% solution of trichloracetic acid, U.S.P.

Trichloracetic Acid, 10% Solution, Moyer—A 10% solution of trichloracetic acid, U.S.P.

Trichloracetic Acid, 3% Solution, Moyer—A 3% solution or trichloracetic acid, U.S.P.

Trichloracetic Acid, 1% Solution, Moyer—A 1% solution of trichloracetic acid, U.S. P.

Tricresol, Moyer—A brand of cresol, U.S.P.

Zinc Chloride, U.S.P., Crystals, Moyer — A brand of zinc chloride, U.S.P.

Zinc Oxide, U.S.P. Moyer—A brand of zinc oxide, U.S.P.

Manufactured or distributed by the J. Bird Moyer Co., Philadelphia, Pa. No U. S. patents or trademarks.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

ASSOCIATION ACTIVITIES

AMERICAN DENTAL ASSOCIATION COMMITTEE ON THE NATIONAL HEALTH PROGRAM

As instructed by the American Dental Association House of Delegates at the St. Louis meeting in October, the Board of Trustees appointed a special committee known as the American Dental Association National Health Program Committee. The five members of this committee are: Harold Oppice, chairman, Chicago, Ill.; Alfred Walker, New York City; Leroy M. S. Miner, Boston, Mass.; C. Willard Camalier, Washington, D. C., and R. M. Walls, Bethlehem, Pa.

December 15, this committee met with members of the Technical Advisory Committee to President Roosevelt's Interdepartmental Committee to Coordinate Health and Welfare. The purpose of the meeting was to discuss and elucidate the A.D.A. House of Delegates' report and recommendations of last October.* All members of the American Dental Association Committee were present except Dr. Miner who, because of previous engagements, was unable to attend. Dr. Marcus Ward, President of the American Dental Association, Lon W. Morrey and Samuel R. Lewis, of the Central Office, and Peter T. Swanish, Ph.D., were also present. The members of the government committee present were: Martha Eliot, J. W. Mountain, G. St. J. Perrott, I. S. Falk and Fred K. Hoehler.

Dr. Martha Eliot of the Children's Bureau, who presided, thanked the committee for presenting the American Dental Association recommendations and stated that the Interdepartmental Committee was most anxious to obtain the viewpoint of all the healing arts and associated groups, as such viewpoints would aid them in preparing their future plans. Dr. Eliot then turned the meeting over to Dr. Oppice who, with the aid of his committee, interpreted the American Dental Association recommendations. Dr. Oppice explained that nothing which his committee might say could be considered binding on the American Dental Association except as such statements were covered by the recommendations of the American Dental Association House of Delegates.

He congratulated the Technical Committee and the Interdepartmental Committee for having recognized a condition which the dental profession has long known existed; namely, that dental disease is one of the most prevalent diseases of mankind. He stated that the American Dental Association had attempted to bring this fact to the attention of the public and government officials for years, but until recently had met with little encouragement.

"Our Committee regrets the fact, however," he said, "that dentistry was not represented in the original deliberations of the Technical Committee. Had such cooperation been obtained, we feel that more specific recommendations for the prevention and control of dental disease might have been included in the Technical Committee's report."

The recommendations of the American Dental Association House of Delegates were then taken up in order. Principle No. 1 needed no explanation. Under principle No. 2, the committee explained that, as a professional body, we must in-

*J.A.D.A., Dec., 1938, p. 2037.

sist that the public receive the service promised them, that high American dental standards must be preserved and perpetuated and that members of the dental profession must be enabled to retain and maintain a high standard in their community. "We are not," stated the chairman, "interested in selfish or personal gain." No explanation was necessary for principle No. 3. Under principle No. 4, the committee explained that the American Dental Association was opposed to any plan that would permit agencies to come between the dentist and the patient and thereby reduce the amount or quality of service which the patient pays for. Principles No. 5 and 6 were self-explanatory. Principle No. 7 needed some explanation. The phrase "highest quality of dental service" was interpreted to mean the highest quality of prophylaxis, extractions, cavity preparations, fillings, etc., not the most expensive type of service.

The eligibility of recipients of this service must be passed upon by local authorities. Different communities would necessarily have to set up different economic ceilings, depending on local conditions.

By rehabilitation of adults was meant the placing of the individual's mouth in such condition that he could be restored to society as a self-supporting citizen.

Principle No. 8 needed no explanation. The committee did, however, insist that the administrator of a dental program or the administrator of the dental phase of a general health program be a dentist and that this dentist have a policy board composed of dentists, and further that both the dental director and the members of the policy board be recommended by the national, state or local dental society wherein the program functions.

Under that part of the report dealing with recommendations, the committee recommended an enlargement and improvement of children's preventive programs.

No further explanation was needed regarding the House of Delegates' recommendation on expansion of hospital facilities.

Under points III and IV, dealing with medical care for the medically needy and a general program of medical care, the committee emphasized the fact that the American Dental Association was opposed to compulsory health insurance as applied to dentistry. The committee stated that any service short of complete dental care would not be satisfactory and that it would be financially impossible for any compulsory health insurance system to furnish complete dental care to insured persons. The committee presented to the Technical Committee copies of a report prepared by Peter T. Swanish, Ph.D., based on figures compiled by the Chicago Dental Society's Industrial Diagnostic Survey Committee. The statistical data compiled from a detailed examination of the mouths of 4,211 industrial employes in Chicago indicate that the average cost of rehabilitating the mouths of these people would be $53.

The Technical Committee entered very freely into the discussion of the various phases of the American Dental Association recommendations. They explained, however, that they were not in a position to answer questions concerning policy. They would refer all such questions to the Interdepartmental Committee.

In conclusion, the American Dental Association National Health Program Committee strongly urged two points: 1. That the Federal government augment, with a comprehensive research program, the efforts of organized dentistry to determine the cause of dental decay. The committee suggested that this program could be conducted in much the same manner as the cooperative program now in operation between the American Dental Association Research Commission and the U. S. Bureau of Standards. 2. That a more comprehensive preventive dental program be developed for children.

RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION ADVISORY COMMITTEE ON RESEARCH IN DENTAL CARIES*

THE American Dental Association, at its recent annual meeting in St. Louis, authorized the Research Commission to proceed with the publication, in book form, of the summaries of findings and conclusions on the cause and control of dental caries received, in response to our open letter dated April 18, 1938, from the 148 authors already heard from, and from all others who may present summaries before the compilation goes to press.

We hope that all who wish to add findings and conclusions will present summaries before January 10, 1939, when the page forms for the book will be closed and the printing expedited. The book will not be a review of published papers. Instead, it will consist of the summaries of findings and conclusions that living authors currently regard as the enduring results of their work and experience—specially and briefly stated, in their own words, for this compilation.

The summaries as presented will be supplemented by various devices intended to make each author's name and summary, each finding, each conclusion and each subject quickly and easily accessible to the reader.

This announcement is, in effect also, our fourth reminder to prospective collaborators who have not yet sent us responses, but from whom we hope to receive summaries, which may be sent to any of the addresses below.

For the Research Commission, by the Advisory Committee on Research in Dental Caries:

DANIEL F. LYNCH, *Chairman,*
1149—16th St., N.W.,
Washington, D. C.
CHARLES F. KETTERING, *Counsellor,*
General Motors Corporation,
Detroit, Mich.
WILLIAM J. GIES, *Secretary,*
632 West 168th St.,
New York City.

*Second open letter to all investigators, throughout the world, in the field of dental caries, November 17, 1938.

REPORT OF THE RESEARCH COMMISSION AMERICAN DENTAL ASSOCIATION*

To the Officers, Board of Trustees and House of Delegates of the American Dental Association:

At the annual meeting of the American Dental Association held in Atlantic City, N. J., July 12-16, 1937, an appropriation in the amount of $15,500 was given to the Research Commission to cover grants and administrative expenses for the fiscal year beginning July 1, 1937 and ending June 30, 1938.

The Research Commission allocated this fund as follows:

1. American Dental Association Research Fellowship at the National Bureau of Standards,	$13,350
2. University of Louisville,	750

*Fiscal year July 1, 1937 to June 30, 1938.

3. College of Physicians and Surgeons,	600
4. Executive Board,	500
5. Secretary's office,	300
Total,	$15,500

The chairman and secretary of the Research Commission held two conferences during the fiscal year at Washington, D. C. The Executive Board held a meeting at Chicago during the Midwinter Clinic of the Chicago Dental Society, for the purpose of discussing the work of the Research Commission at the National Bureau of Standards. Wilmer Souder, chief of the Dental Research Laboratory at the National Bureau of Standards, represented the Bureau at this meeting. Marcus L. Ward, President Elect of the American Dental Association, attended the meeting as a guest and assured the Commission that they would have his whole-hearted support during his administration.

COMPARATIVE FINANCIAL STATEMENT

Table 1 shows the expenditures during the fiscal year 1937 and 1938.

Because of the death of Theodore B. Beust, the allotment for the University of Louisville was canceled as of December 31, 1937, leaving an unexpended balance of $375. This was reallocated with the consent of the Board of Trustees at the midwinter meeting of the Executive Board; $150 to the A.D.A. Fellowship at the National Bureau of Standards and $225 to the Advisory Committee on Research in Dental Caries.

GRANT NO. 1: AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

The work of the Fellowship continues to be fruitful and, judging by the volume of correspondence relating thereto, is of very widespread interest. The Research Commission is particularly pleased with the excellent support which the Association officials have accorded the work with the Bureau. This, together with the dentists' utilization of the program and the whole-hearted cooperation of the manufacturers of dental materials, has made the chairman's and the secretary's labor very enjoyable.

The Commission at the present employs four full-time research associates, a dentist (George C. Paffenbarger), a physicist (W. T. Sweeney), a mechanical engineer (John R. Beall) and a chemical engineer (H. J. Caul). All of these men work in the Bureau's laboratories and are subject to the rules and regulations to which the Bureau employes are subject. Two Bureau staff members are assigned by the director to investigation of dental materials, a physicist and chief of laboratory (Wilmer Souder) and a chemist

TABLE 1.—EXPENDITURES DURING 1937-1938

	Allocation for 1937-1938	Disbursed June 30, 1938
American Dental Association Research Fellowship at the National Bureau of Standards	$13,500.00	$13,729.45
University of Louisville	750.00	375.00
Research on local anesthesia, College of Physicians and Surgeons	600.00	467.11
Advisory Committee on Research in Dental Caries		132.15
Executive Board	500.00	485.17
Secretary's office	300.00	311.12
	$15,500.00	$15,500.00

(Irl C. Schoonover). Equipment and consulting services of any of the Bureau's facilities may be used in our cooperative effort. We are indeed fortunate to be in a position to utilize the vast resources of the National Bureau of Standards in solving some problems of unique interest in dentistry. Lyman J. Briggs, the Director, is sympathetic with and interested in dental problems and he believes that the liaison with the American Dental Association through its Research Commission is one of the most pleasant and productive connections of outside organizations with the Bureau. The Commission is very appreciative of Dr. Briggs' attitude.

Service to and Relationship with Manufacturers of Dental Materials.—From time to time, manufacturers of dental materials call on the Bureau and the Research Associates to assist them in the calibration of their testing equipment by the interchange of data on a material or a standard sample. In addition, the Bureau has often been called on for advice and information regarding the type and design of equipment suitable for testing dental materials.

In the survey of dental materials, defects have been discovered in certain products. The manufacturers have been informed of these either by letter or in conference. To illustrate this program in a specific manner, we cite the silicate cement investigation which was completed last year. In testing one prominent brand of silicate cement, it was found that different batches of powder and different batches of liquid were by no means identical in quality and that test specimens made from certain batches of powder and liquid were as much as three times as soluble as specimens made from certain other batches. Methods of detecting such variations, including specific procedure for this type of testing, were communicated to the manufacturer by letter and in conference. Assurances were given that the foregoing condition would be corrected.

The opacities of human tooth tissues and of silicate cements were numerically determined and compared. It was found that two prominent brands were too translucent and another was too opaque. This evidence, together with methods of testing, was presented to the manufacturers of the involved products. The firms changed their products accordingly.

The arsenic content of silicate cement liquids supplied by two concerns was found to be unnecessarily high; that is, higher than the arsenic content of reagent quality phosphoric acid. As soon as the companies were informed of the findings, the situation was immediately corrected. The arsenic content in any instance was remarkably small and certainly was not of any serious consequence as the same situation was noted in the case of the zinc phosphate cement liquids. All of the cement liquids which have been recently tested have had the minimum arsenic content that can be secured in commercial products. The cement specifications have a requirement permitting a maximum of only two parts of arsenic in 1,000,000, an almost infinitesimal amount. This is an excellent example of the Bureau's cooperation. It is estimated that the Bureau spent between $1,000 and $2,000 in developing and establishing an accurate and feasible method of determining the amount of arsenic in silicate cement.

Numerous other instances involving the silicate cement investigation could be cited. What has been said of silicate cements can be said of all the other dental materials which the Fellowship and the National Bureau of Standards have jointly investigated.

Thus it can be seen that the program is exerting a tremendous effect on the manufacturing and the selling of dental materials, an effect that is traveling in one direction—the constant improvement of restorative dental materials. Manifestly, the Research Commission is very proud of its record. The manufacturers

are not only following the program, but are also cooperating with us and have frequently expressed both orally and in writing their desire to go along with the dental profession in the program and policies of the Research Commission.

Prestige in Dental Educational and Literary Circles.—The influence of the research work on dental materials at the Bureau on the subject matter in textbooks on various phases of dentistry is constantly increasing. One can scarcely find a recent textbook on operative or prosthetic dentistry without finding many references to the work. This holds true for foreign as well as for domestic textbooks. Text and reference books on dental materials, technology and metallurgy contain a tremendous amount of material taken directly from the published reports. The educational influence of these reports and this program is in itself far more than ample to justify all expenditures by the Research Commission on the A.D.A. Fellowship at the National Bureau of Standards.

Cost of Program.—The Research Commission is carrying on its portion of the work at the National Bureau of Standards at the low cost of 32 cents for each member of the American Dental Association. One must remember, however, that this low cost is possible only through the whole-hearted cooperation of the Bureau, whose contributions to the program work are difficult to state in terms of dollars and cents.

Manufacturers do not contribute any funds to assist in the program and no charges are made to the manufacturers for tests conducted by the Fellowship. With this policy, the Commission is under no obligations whatsoever to the manufacturer.

It is gratifying and somewhat surprising to note the fact that improvements in quality of dental products as a result of our program have not been reflected in increased prices of materials to the profession.

Certified List.—Under the heading of "Association Activities," the Research Commission reports and findings are being published in THE JOURNAL. Here, the profession can find lists of certified materials which have been tested by the American Dental Association Research Fellows at the National Bureau of Standards. These lists are evidently being used by the profession as a guide in the purchasing of dental materials.

Following is a technical report of the senior Research Associate at the National Bureau of Standards:

OUTLINE OF THE COOPERATIVE DENTAL RESEARCH BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE AMERICAN DENTAL ASSOCIATION (1937-1938)

The cooperative research work on dental materials for the fiscal year 1937-1938 includes (1) silicate cements, (2) denture base materials, including synthetic resins, (3) hydrocolloidal impression materials, (4) a program of cooperation with dentists (extension courses and clinical testing of materials), (5) testing of certified materials and (6) miscellaneous activities.

1. Silicate Cements.—A method for determining the water-soluble arsenic content of hardened silicate cements was perfected. This together with the completion of the analysis of two silicate cement liquids and one powder terminated the three-year research on the silicate cements. The complete report of this investigation was reduced approximately one-third for publication. The American Dental Association Tentative Specification No. 9 for Dental Silicate Cement, an integral part of the foregoing report, was adopted by the House of Delegates of the Association in July 1937 and became operative July 1, 1938. Samples of cements which are certified by their manufacturers as complying with Specification No. 9 are now being procured on the retail market for testing.

2. Denture Base Materials.—Tests designed to define the physical properties of satisfactory denture rubbers are being developed. Included among these tests are (1) determinations of plasticity and tackiness, which, when taken together, indicate the so-called "packing qualities" of denture rubber and clearly separate the satisfactory from the unsatisfactory brands and (2) determinations of stiffness, strength and deflection by means of cross-bend tests, which definitely divide the rubbers into distinct classes.

In cooperation with the Army Dental Corps, through Walter Reed Hospital Dental Clinic, with Georgetown University Dental School and with the University of Pittsburgh Dental School, a series of clinical tests involving the use of experimental dentures were made. Twelve dentures have been made to date using "Aldenol," "Duratone," "Luxene," "Vernonite" and rubber. Dimensions of these dentures were determined by measurement and by making artificial stone models of the bearing surface of each denture. None of these dentures has been in service long enough to warrant any specific conclusions regarding constancy of shape or dimension. However, no serious changes have been detected.

A questionnaire relating to the development of a satisfactory specification for vulcanite was prepared and forwarded to manufacturers and dental schools.

3. Hydrocolloidal Impression Materials.—An investigation of six brands of colloidal impression materials was begun, with the preparation of a tentative specification for these materials as the ultimate goal. The strength and deformation of the materials when compressed was somewhat indicative of their behavior when used in taking impressions of undercuts. The stronger materials did not break even when the undercuts were severe. A material was prepared from a formula found in the literature. The properties of this material are being determined along with the currently used ones.

4. Program of Cooperation with Dentists.—During 1937-1938, the cooperative work with dentists has been one of the major activities of the Fellowship. At the present time, investigations of silicate cements, amalgam alloys and colloidal impression materials are in progress. The general purpose of this cooperative program is in the main educational. The specific aims are (1) to intercompare clinical and laboratory data which the dentists collect in their practices with those derived by the National Bureau of Standards Group, (2) to secure from dentists information which will assist the Bureau workers in formulating specifications, (3) to diffuse the results of the National Bureau of Standards laboratory's investigations of dental materials by giving groups of dentists extension courses in the use and in the selection and evaluation of dental materials, (4) to transfer the laboratory findings into clinical practice and (5) to evaluate certain advertising claims.

(a) Silicate cements: After completion of the research report on silicate cements, the Research Commission selected approximately 200 dentists located in various sections of the country to cooperate with the Fellowship in an investigation of the silicate cements. Instructions regarding fourteen practical experiments which the dentist can perform in his own laboratory, together with the necessary equipment for conducting them, were mailed to the cooperating groups. These experiments demonstrate the effect of varying manipulative procedures on the time of setting, porosity, opacity, solubility, etc., as well as the relative acidity, opacity and other properties of different trade brands. When the work is completed, a detailed report of the investigation will be prepared in the manner heretofore employed.

(b) Amalgam: A laboratory investigation of an amalgam which was advertised as being ". . . completely and permanently non-tarnishing in all animate oral

conditions" indicated that there was considerable doubt about such a claim. Consequently, the Research Commission selected a committee of about forty dentists to evaluate clinically the tarnish resistance of this amalgam. To each member of the committee were sent (1) two amalgam alloys, labeled A and B and packed in plain glass vials, one the so-called non-tarnishing alloy; (2) precise instructions on mixing, packing and polishing; (3) the materials to be used in polishing the fillings, and (4) a blank form for reporting observations.

The conclusions of all the dentists have not been received, but the indications are that the non-tarnishing claim is without basis in fact.

cooperators is approximately the same as the rating given by the Bureau laboratory workers upon the basis of physical property data.

The committee was organized by P. C. Lowery.

5. Testing Certified Materials.—The testing program has included complete surveys of the lists of wrought gold wire alloys, zinc phosphate cements and amalgam alloys and tests of those products offered for certification by the manufacturer during the year. The results of the complete program of testing are given in Table 2.

Prompt publication of the results of this testing program made it very effective. The workers are greatly indebted

TABLE 2.—TESTING OF CERTIFIED MATERIALS

Material	Number Tested	Number Complying with Specification	Number Failing to Comply with Specification
Amalgam alloy	62	51	11
Investment (inlay)	1	1	
Impression compound	1	1	
Wax (inlay)	1	1	
Casting gold alloys (inlay)	32	24	8
Mercury	3	1	2
Wrought gold wire	17	16	1
Zinc phosphate cements	13	9	4
Total	130	104	26

The silicate cement and amalgam committees were organized by R. H. Volland.

(c) Colloidal impression materials: Samples of six brands of colloidal impression materials were forwarded to a committee of fourteen prosthodontists. Before sending, the samples were removed from the original packages, and after the addition of a small quantity of coloring and flavoring agents to mask their identity, they were repackaged in celluloid tubes. The samples were identified by code letters and had widely different values for many of their physical properties. Each man was requested to report his appraisement of each material. The reports received to date indicate that the relative rating given the materials by the

to the Editors of THE JOURNAL for their assistance and cordial cooperation. A perusal of Table 2 shows that of 130 products guaranteed by the manufacturers to comply with the specification, about 20 per cent failed to comply.

Samples are being procured for a survey of (1) the zinc phosphate cements which have been certified to comply with the revised A.D.A. No. 8 Specification for Zinc Phosphate Cements and (2) the silicate cements. Both the revised zinc phosphate and the silicate cement specifications become effective July 1, 1938.

Tests are in progress on fifteen newly certified materials.

There are at present on the list of

certified products, 51 amalgam alloys, 8 inlay casting investments, 9 impression compounds, 7 inlay waxes, 67 inlay casting gold alloys, 14 mercuries, 16 wrought gold wire alloys and 9 zinc phosphate cements; a total of 181 products, an increase of approximately 18 per cent over the number of last year. These materials are not only safe to use, but are also of high quality and are marketed at a price which has not been increased as a result of this standardization.

6. Miscellaneous Materials.—(a) Specification revision: The first revision of the American Dental Association Specification No. 8 for Zinc Phosphate Cement was completed. The House of Delegates of the Association adopted the revision as the official specification in July 1937, and it became effective July 1, 1938.

(b) Materials used to prepare indirect inlay models: Significant physical properties of two special gypsum materials, "Akratex" and "Diolite," were compared with those of two currently used rapid-hardening artificial stones. The differences among the four materials were unimportant. In fact, any of the currently used artificial stones having a "hydrocal" base and a setting expansion of 0.10 plus or minus 0.05 per cent are satisfactory for indirect inlay models.

(c) Investigation of nonshrinking zinc phosphate cement: A German-made zinc phosphate cement, which did not shrink appreciably in air or under water, was found to have serious defects, such as a long setting time. The characteristics of the cement indicated that it was very similar to the old types of cements, which consisted of a powder of zinc oxide and a viscous liquid.

(d) Cooperation with dental schools and public institutions: The following institutions have received service from or have been in active cooperation with the Fellowship.

California: University of California, College of Physicians and Surgeons, University of Southern California and Stockton State Hospital.

District of Columbia: Veterans Administration, Army Dental Corps, U. S. Public Health Service, Georgetown University, Navy Dental Corps and Howard University.

Georgia: The Atlanta-Southern Dental College.

Illinois: Northwestern University, University of Illinois and Loyola University.

Indiana: Indiana University.

Maryland: University of Maryland.

Massachusetts: Harvard University.

Michigan: University of Michigan.

Minnesota: University of Minnesota.

Nebraska: State Board of Control and Creighton University.

New York: New York University and University of Buffalo.

Ohio: Western Reserve University.

Pennsylvania: University of Pittsburgh, Temple University and University of Pennsylvania.

Virginia: Medical College of Virginia.

Wisconsin: Marquette University.

Compressive strength determinations were made on a zinc phosphate cement with and without an admixture of eugenol for the Medical College of Virginia on specimens furnished by them.

(e) Constant temperature cabinet: A constant temperature cabinet designed for testing amalgam and denture materials at mouth temperature was built and installed.

(f) Additional Research Associate: H. J. Caul, chemical engineer, reported for duty as research associate of the American Dental Association August 30. He has been engaged principally in analyzing certified amalgam alloys, certified gold alloys and specification testing involving chemical procedure.

(g) Visitors: Among the 124 people who visited the laboratory during the last fiscal year were representatives of France, England, Canada, Australia, Norway and Germany. Several of these foreign visitors explained that the work of this laboratory was closely followed in their respective countries.

(h) Lectures before dental groups:

Reports of the work were presented before the following dental organizations:

The Piedmont Dental Society, Danville, Va.

The New England Dental Society, Boston, Mass.

Academy of Stomatology, Philadelphia, Pa.

Akron Dental Society, Akron, Ohio.

Stark County Dental Society, Canton, Ohio.

The Corydon Palmer Dental Society, Youngstown, Ohio.

The Cleveland Dental Society, Cleveland, Ohio.

The Toledo Dental Society, Toledo, Ohio.

Georgetown University Dental School, Washington, D. C.

It is estimated that about 850 dentists were present when the lectures were given.

(i) Reports on work: The following reports on the work were published during the year:

1. Research Commission Report—List of Certified Products. J.A.D.A., 24:1355, August 1937.

2. Research Commission Report—List of Certified Wrought Wire Alloys. J.A.D.A., 24: 1702, October 1937.

3. Paffenbarger, G. C., and Beall, J. R.: American Dental Association Specification No. 8 for Dental Zinc Phosphate Cement (First Revision, Effective July 1, 1938). J.A.D.A., 24:2019, December 1937.

4. Paffenbarger, G. C.; Schoonover, I. C., and Souder, Wilmer: Dental Silicate Cements: Physical and Chemical Properties and a Specification. J.A.D.A., 25:32, January 1938.

5. Research Commission Report—List of Certified Products. J.A.D.A., 25:475, March 1938.

6. Research Commission Report—List of Certified Amalgam Alloys. J.A.D.A., 25: 981, June 1938.

7. Paffenbarger, G. C., and Beall, J. R.: Investigation of Four Gypsum Model Materials Used to Prepare Indirect Inlay Models. J.A.D.A., 25:1146, July 1938.

Respectfully submitted,

GEORGE C. PAFFENBARGER,
Research Associate.

An outline of the research program, which has been in active progress, was prepared by the Commission, the Fellowship and the Bureau, as follows:

OUTLINE OF RESEARCH PROGRAM ON DENTAL MATERIALS BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION (1938-1939)

I. Colloidal Impression Materials.
   1. Continue present investigation which includes:
      (a) Physical properties in compression.
      (b) Impression taking qualities.
      (c) Cooperative work with dentists.
   2. Determine physical properties in tension.
   3. Write specification.

II. Denture Base Materials.
   1. Continue investigation of vulcanite and formulate specification for different types.
   2. Continue practical investigation of denture materials with Army Dental Corps, dental schools and dentists.
   3. Draw up specification for phenol-formaldehyde type.

III. Base Metal Alloys.
   1. Brands to be investigated:
      (a) Vitallium.
      (b) Ticonium.
      (c) Lunorium.
      (d) Wipla.
      (e) Kromel.
   2. Compare physical properties (having a dental significance) of the foregoing base metal alloys with properties of several types of partial denture gold alloys such as:
      (a) Oralium—white color—low gold content.
      (b) New-Oro G-W—white color—high gold content.
      (c) Dee No. 4—Four type.
      (d) S. S. White No. 750—light yellow color—high gold content.
   3. Determine compositions of all the foregoing alloys and correlate with physical properties if possible.
   4. Determine shrinkage on casting.

5. Make discoloration tests.
6. Determine compositions and physical properties of investments and other accessory materials.
7. Investigate accuracy of casting technics and accuracy of castings made by commercial laboratories.
8. Carry out measurements and interpretation of electromotive force generated between different combinations of base and precious metal alloys.

IV. Specification Revision.

1. Specification No. 1 for Dental Amalgam Alloy:
   (a) Quantitative test for blackening on mixing.
   (b) Dimensional change measurements at 25° C., 31° C., 37° C. and 43° C. (77° F., 88° F., 99° F., 109° F. approximately and respectively).
   (c) Flow determinations at 25° C., 31° C., 37° C. and 43° C. under loads of 250 and 125 kg./cm.^{2}
   (d) Tensile or transverse strength tests.
   (e) Ageing tests.
   (f) Air pressure tests.
   (g) Possibility of changes in composition requirements.
   (h) Foregoing tests to be made on several types of amalgam including:
      h-1. high flow—more than 5 per cent.
      h-2. low flow—less than 1 per cent.
      h-3. expanding.
      h-4. shrinking.
2. Specification No. 2 for Inlay Casting Investment:
   (a) Tests for cracking during heating.
   (b) Test for hygro-expansion properties.
   (c) Specification in greater detail test for thermal expansion.
   (d) Modification of test for fineness.
   (e) Investigation of possibility of feasible changes in specified values for thermal and setting expansion.
3. Specification No. 5 for Inlay Casting Gold Alloys:
   (a) Add a fourth classification—D—extra hard with appropriate requirements.
   (b) Investigate possibility of decreasing noble metal content.
   (c) Delete silver requirement.
   (d) Investigate possibility of substituting tarnish and corrosion tests for chemical composition requirements.
   (e) Eliminate reduction of elongation for platinum content.
   (f) Determine fusion temperature on same diameter as cast rod or section of ingot.
   (g) Make tests for defining color.
   (h) Reclassify the types based upon hardness, leaving a definite gap between each type.
4. Specification No. 7 for Wrought Gold Wire:
   (a) Investigate possibility of decreasing noble metal content.
   (b) Investigate possibility of substitution of tarnish and corrosion tests for chemical composition.
   (c) Specify two types of wire—heat treating and non-heat treating.
   (d) Delete fusion temperature, increase quenching temperature and adjust physical properties accordingly.
   (e) Include a test for "hot shortness."
5. Specification No. 8 for Zinc Phosphate Cement and Specification No. 9 for Silicate Cement:
   (a) Prepare report giving detailed procedure for determining the arsenic content of dental cements.

V. Testing Program.

1. Conduct specification tests on newly certified materials.
2. Test zinc phosphate cements which have been certified to comply with revised specification (effective July 1, 1938).
3. Test silicate cements which have been certified to comply with new silicate cement specification (effective July 1, 1938).

4. Resurvey materials on certified lists of:
   (a) Inlay casting investments.
   (b) Inlay casting waxes.
   (c) Impression compounds.

VI. Educational Program.
1. Prepare reports and exhibits.
2. Present reports and exhibits before representative dental societies.
3. Organize a lecture, demonstration and clinical course to be given as extension work before dental organizations and schools throughout the country.
4. Continue cooperative investigation of dental materials with dentists.
5. Continue cooperation with manufacturers, advising them on testing methods and possibilities for improving their products.

VII. Projected Program.
1. Fused dental porcelains.
2. Burs and stones.
3. Instruments.

GRANT NO. 2: UNIVERSITY OF LOUISVILLE

Grant No. 2., an allocation of $750, was used entirely for the purpose of assisting the late Theodore B. Beust in his research laboratory. The allocation was discontinued after his death. Dr. Beust was the recipient of grants from the Research Commission for fifteen years, a testimonial of the great respect in which he was held. At the time of his death, Dr. Beust was working on a histologic study of enamel, a study of microscopic flora of the mouth and studies on the activity of dentin on irritation, and was correlating all of his research toward determining the cause of dental caries.

Bibliography for 1937-1938:

Morphology of Fusiform Bacillus. J. D. Res., 17:379, October 1937.

Genesis of Periodontium. J.A.D.A., 25:114, January 1938.

GRANT NO. 3: COLLEGE OF PHYSICIANS AND SURGEONS

The Research Commission allocated $600 for the partial support of the work at the College of Physicians and Surgeons during the last fiscal year. The following report was submitted by M. L. Tainter, who is in active charge of the work:

In the Department of Pharmacology, studies have been completed on the toxicity of various local anesthetic mixtures in experimental animals, with particular reference to their vasoconstrictor components. These studies are directed at the determination of whether there is any experimental basis for the claim that any one type of local anesthetic mixture containing procaine is less toxic than any other. These experiments are being paralleled by similar studies in the clinic, where the various solutions are being tested on patients by the blind test technic to determine their relative toxicity, effectiveness and general suitability under conditions of actual practice. Between 400 and 500 cases have been studied clinically under a variety of conditions and with results that warrant extensive publication of the conclusions. The results of these studies are being presented at the annual meeting of the International Association for Dental Research.

There has been completed a study of the efficacy of various hemostatics advocated for use by mouth for the diminution or control of postoperative hemorrhage. It has been shown that calcium, when taken in maximum doses, orally over prolonged periods of time, with or without massive doses of viosterol, ceanothyn and styptysate, has no definite power to shorten the coagulation time of human blood. No basis was found, therefore, for their use clinically for the control of bleeding.

Extensive determinations of a similar nature have been conducted on the other alleged clinical hemostatics of the tissue extract group. These results are very largely completed and will be submitted for publication within the course of a few months. These coagulation tests that have been made are unique in that a technic previously not used has been em-

ployed; that is, repeated control observations have been made over periods of days or weeks and the average coagulation time, from these numerous observations, has been compared with a similar series of measurements made with the patient under the influence of the hemostatic. There has thus been afforded the opportunity of testing the value of these materials under conditions where the spontaneous variability of coagulation time has been ruled out by securing an adequate body of data to give reliable average figures.

The difference in the clinical effects of procaine solutions, when used buffered and unbuffered, has been investigated in the oral surgery clinic. The results are not yet complete, but are so well along that results from this study can be confidently predicted. The object of the study is to determine what, if any, difference it makes if a solution buffered to a near normal pH or the ordinary acid solutions, which are more stable and which are frequently used, are employed.

It has been shown for the first time that the sodium bisulfite, which is put in practically all the epinephrine and cobefrin solutions for the purpose of stabilizing the drug, demonstrate very definite irritating properties at the site of injection. This raises the question as to whether the local irritation produced by these vasoconstrictors may not be due in part to the presence of the preservatives commonly found in them. Studies have been initiated for the development of preservative materials that will not be irritating, but since the preservative power has to be observed months or years, the results of these studies will not be available for a considerable period of time.

An investigation has been begun on the pharmacologic activity of materials commonly present in dentifrices and mouthwashes. Special attention is being directed to sodium lauryl sulfate, a new soap substitute which has made its appearance in several of the most prominent dentifrices and in many other cleansing preparations. Chronic feeding experiments with this material are going on to determine its toxicity and what pathologic lesions its continued intake might produce. This seems to be an especially important line of investigation because people using a dentifrice daily containing this material may expect to swallow some of it in the saliva and thus be continually exposed to its action. It therefore is quite important to determine whether it has any significant degree of systemic toxicity when taken into the body over long periods of time. This material has been put on the market and added to these types of preparations without any evidence being obtained as to whether its toxicity would be such that this use of it would be safe. The present studies, therefore, are extremely important in testing a possible source of chronic poisoning.

The publications covering these studies are listed herewith:

1. Local Irritation from Sodium Bisulphite as Preservative in Epinephrin Solutions. Proc. Soc. Exper. Biol. & Med., **36**:584, 1937.

2. Topical Anesthesia of Mucous Membranes of the Mouth. J. D. Res., **16**:351, September 1937.

3. Comparative Value of Various Vasoconstrictors in Local Anesthetic Solutions. J. D. Res., **16**:352, September 1937.

4. A Comparison of Procaine Hydrochloride and Procaine Borate as Local Anesthetics. J. D. Res., **16**:352, September 1937.

5. Effects of Oral Hemostatics on Coagulation Time. J. D. Res., **16**:354, September 1937.

6. Studies on Topical Anesthesia. II. Further Observations on the Efficacy of the More Common Local Anesthetics When Used on the Gums and Oral Mucosa. J.A.D.A., **24**:1480, September 1937.

7. Influence of Vasoconstrictors on the Toxicity of Procaine Anesthetic Solutions. J.A.D.A., **25**:966, June 1938.

M. L. TAINTER, *Chairman,*
Committee on Research,
College of Physicians and Surgeons,
A School of Dentistry.

The Commission is well pleased with the quality and the practical usefulness of the work of Dr. Tainter and his associates, but because of the nature of the work and the type of materials being studied, it is recommended that the study be made under the auspices of the Council on Dental Therapeutics.

(To be continued in February)

CORRECTION

In the list of certified materials in November, page 1859, the casting gold alloys manufactured by Henry F. Bruce Co., should read as follows:

Bruce "A," Type A; Bruce "O," Type B; Bruce "No. 5," Type C.

General Refineries; Crown Knapp No. 3, should read Type C.

Precious Metals Research Works, Inc., page 1859, alloys should read: Research A soft, Type A; Research B Medium, Type B; Research Hard Cast No. 5, Type C.

We apologize for the errors, and are pleased to make the corrections here.—Ed.

COMMITTEE ON LEGISLATION

ANIMAL EXPERIMENTATION AND SCIENTIFIC MEDICINE ENDORSED BY VOTERS

THE voters of California and Colorado, November 8, by overwhelming majorities emphatically rejected proposals made in those states to undermine the structure of scientific medicine. In California an initiative humane pound law, so called, proposing to cripple scientific research by hampering animal experimentation, was decisively defeated. In Colorado an initiative measure proposed by a group of chiropractors, to debase the quality of medical care in the state by repealing the basic science act and by destroying other safeguards that have been erected to assure adequate and scientific medical service, was met by an avalanche of negative votes, running as high as ten to one in some counties.

In Oklahoma an initiative measure that would have sanctioned practices not conducive to public welfare failed to get on the ballot, because of court action instituted by the medical profession. In Ohio a chiropractic initiative somewhat similar to the Colorado initiative died aborning, the cultist sponsors apparently becoming disheartened shortly after the proposal was submitted to the attorney general for his approval as to form. Petitions in Ohio were not circulated and the proposed initiative measure was not submitted to the people for a vote.

The medical associations in the states named assumed the lead in thwarting the selfish interests behind these proposals, interests that would subordinate the public welfare to their own private ends. In California and Colorado the state medical associations, aided by many lay and other professional groups and by public spirited citizens, informed the people fully of the dangers implicit in the proposals. To bring these dangers to the attention of the voters necessitated great sacrifices of time and money, but the results show that such sacrifices were well worth while and indicate that an informed electorate will support scientific medical care under proper legal and ethical safeguards.—*J.A.M.A.*, 111:1938, November 19, 1938.

AIDING AND ABETTING

BEFORE the California Appellate Court in 1914 came the case wherein the point was raised of aiding and abetting an unlicensed person in the practice of dentistry, and that part of the statute which makes aiding and abetting a ground for canceling the certificate of a licensed person was held as valid. (Lassen v. Board of Dental Examiners, 24 Cal. App. 767. 1914.) The same question was raised in an eastern court and that tribunal held that the assisting of an unregistered person in the practice of dentistry is grounds for revocation. (Davis v. Calderwood, 251 Mass. 283. 1925.)

The courts of California were again called on to decide the validity of the statute as it relates to aiding and abetting when, in 1927, the cases of Osborne v. Baughman, 85 Cal. App. 224, and Meaghes v. Board of Dental Examiners, 87 Cal. App. 193, were brought for judication. The statute was upheld as valid. A later case of aiding and abetting was held sufficient for revocation. The accused took exception to the rules of the board in its conduct of the hearing. The court held that the rules of pleading in criminal cases do not apply to proceedings before the board. A writ of certiorari was asked on the grounds of prejudice of the members of the board. The writ was denied by the court, with the statement that prejudice of members does not disqualify members from hearing the proceedings. In this case, the action of the Superior Court in reversing the action of the Board was held as error. (Winning v. Board of Dental Examiners, 114 Cal. App. 658; 300 Pac. 866. 1931.)

NEW JERSEY LAW AGAINST ADVERTISING UPHELD

THE New Jersey State Supreme Court, October 18, upheld the constitutionality of the state dental practice act, enacted in 1934.

The state board of registration and examination in dentistry had suspended the license of Dr. William Levine, of Jersey City, for violation of that provision of the act prohibiting dentists from advertising prices, and a test suit appealing this action of the board followed.

The board had twice previously revoked this license, only to have it restored on technicalities following appeal and court action.

Counsel for Dr. Levine contended that the law deprived a dentist of constitutional rights and vested the board with improper exercise of police powers.

The New Jersey Supreme Court ruled, in an opinion written by Justice Bodine,

It is clear that the legislature of this state, in authorizing the revocation or suspension of the license of a dentist who advertised his product, or the price, or charges to be paid therefor, or the durability of his work in defiance of the manner specified in the act, was enacting a law necessary to protect the public from the wiles and artifices of charlatans.

The issue before the state board in suspending his (Dr. Levine's) license upon the charges made was simply whether he had resorted to the prohibited practice, and it is not necessary for it to investigate the truth or falsity of the advertisements adduced, since they admittedly offend against the legislative concept of proper dental practice.

The practice of dentistry is not a business but a privilege, and the practice thereof is subject to state regulation in the interest of the public. It is proper that the state should take steps to prevent licensed dentists from resorting to the well-known practice of charlatans and quacks.

BUREAU OF PUBLIC RELATIONS

REFRESHER COURSES IN CHILDREN'S DENTISTRY: ORGANIZATION—ADMINISTRATION—RESULTS

By J. G. Williams,* D.D.S., Atlanta, Ga.

BEFORE taking up my subject, may I express appreciation to Dr. Frank C. Cady, dental consultant of the United States Public Health Service for his efforts to promote refresher courses in children's dentistry, and particularly for his assistance in organizing the refresher course held in Georgia May 23-27.

I believe whole-heartedly in the value of refresher courses in children's dentistry (1) because there is great need for improved methods in the practice of children's dentistry and (2) because dentists are realizing their own deficiencies in regard to this service. That there is a need for education among the profession in the subject of children's dentistry cannot be doubted by any one who has an opportunity for wide observation. Many dentists never attend dental meetings, clinics or postgraduate courses. Others who attend regularly avoid the sections on children's dentistry because they have been disappointed, financially and otherwise, in their own results in handling children and they consequently wish to do as little work for children as possible. The public is being educated to demand efficient dental care for children, therefore the dentist must equip himself to meet this demand. The dental profession as a whole is ready for help and this is the time to stress the important subject of children's dentistry.

Objectives should be the first consideration in the organization of refresher courses. If we know what we wish to accomplish, ways and means will be more easily fitted to the task and results more readily measured. Our objectives should be determined by the needs in our own state. In general, I believe the objectives should be:

1. To aid the practicing dentist, whether a member of organized dentistry or not, regarding the management of children and the technic of children's dentistry.

2. To give dental health and preventive dentistry their rightful place in public health and education programs.

3. To enlist the interest of dentists in the general health program of the state and create a closer relationship between the dental profession and the state department of health with all of its allied agencies.

While these are the general objectives of refresher courses, we may have specific objectives to meet the problems in our own locality. When objectives have been agreed on, we are ready to proceed with the organization. After the necessary preliminary arrangements have been completed with the director of the state department of health, the dental director is in charge. The support of the state dental association for such an undertak-

*Director, Division of Dental Health Education, Georgia State Department of Public Health.

Read before the American Association of Public Health Dentists, St. Louis, Mo., October 24, 1938.

ing is essential. There should be a committee to advise with the director, perhaps a committee on health education, a public health committee or an advisory committee to the state department of health. In any case, this committee should be made up of dentists interested in children's dentistry and in public health. This group should consult with the director in the very important job of selecting the clinician, who should be chosen because of his ability to most nearly supply the needs. The clinician should be consulted in the formation of the program.

In planning the program, the following subjects, which seem to be in accord with the objectives of refresher courses, should be included:

Subjects for the clinician:

1. A clinic on operative dentistry by the use of lectures, slides, moving pictures, models, etc.
2. Management of the child patient.
3. The business phase of children's dentistry.

Other topics:

1. Discussion from the public health point of view, by the director.
2. Discussion from the point of view of the school, to be given by some educator. If this person is not available in the department, he can be obtained from the state department of education or from local school officials.

If the program is planned to include a night meeting, it would be an excellent idea to invite the public, especially school and health officials, parent-teacher associations, civic clubs, etc. The theme for such a meeting would be "Dental Health Education," the discussion being led by state or local school superintendent or commissioner of health.

The meeting place is the next point in organization. Population of dentists, hotel and meeting place facilities and accessibility for auto travel must be considered. If we wish to reach the man who most needs help, we must take our program to him. In Georgia, we covered our state by selecting five conveniently located centers.

The success of attendance will depend in great measure on publicity. Much consideration should be given to the question as to the best way to bring the meetings to the attention of the dentists and public throughout the state. There are numerous ways that this may be done. At least two dentists should be selected to act as hosts and make all necessary arrangements in each locality where the meetings are scheduled. It is well to have a representative from the dental health education division of the state department of health visit each center prior to the meeting to assist the local committee in working out the details. Newspaper publicity should be widely used, with a lead of three or four weeks, using pictures of the clinician in the Sunday papers throughout the state. Publicity may be given in all local papers about two days before the meeting. It is suggested that the director of the dental division send a series of letters to all dentists whether members of organized dentistry or not. Self-addressed reply cards enclosed in these letters will serve two purposes: They indicate the number of men attending and, through these cards, that the dentist has made a definite engagement. These letters should follow the general announcement in the paper, The refresher course should receive publicity through the state dental journal and state and district dental meetings. It would be well to have the president of the state dental association send a letter to all dentists urging them to take advantage of the course; a reminder card going to them from the dental director several days before the meeting. The committee in charge of local arrangements, where there are to be several meetings over the state, can send invitations to all dentists within a radius of about 100 miles. An opportunity that might be overlooked, and one that is, I

think, very important, is the invitation to county commissioners of health and public health nurses. These workers are necessary to the success of our efforts. To insure their attendance, letters may be sent from the state director of county health work to all county commissioners and from the director of public health nursing to field workers. This is good publicity whether they attend or not. All of this may sound like too many details, but they are necessary if we are to set the stage properly for this show.

The responsibility for administration rests with the director. Whether there is a one or more days' program, it is important to strike a serious, business-like note, beginning and closing on time and proceeding on schedule and never allowing the program to lag. Our men were asked to assume an "in-school attitude." Pencils and pads furnished for writing questions and taking notes add to the school atmosphere. I have never seen men listen so earnestly and attentively. During the five Georgia meetings, not one dentist left during the program. The credit for this is due largely to Dr. McBride.

Lectures and slides should be allowed to proceed uninterrupted, written questions being saved for the discussion hour at the lunch table or at the close of the meeting.

At the close of the morning session, it is advisable to adjourn to a private dining room where lunch has been ordered, but to proceed immediately with the questions. Those pertaining to children's dentistry should be answered by the clinician or some pedodontist. Questions on public health should be answered by the dental director, and those regarding education by some school official.

Possibly the most difficult problem is the demonstration with children. Results are doubtful. If the necessary equipment and sufficient space for observation by the men can be provided, certainly it is worth while. In Georgia, local chairmen had been instructed to bring to the committee room six or eight young children presenting problems which ordinarily confront the average dentist. Portable chairs were used and the men observed Dr. McBride's approach and management of the child and discussed conditions found. This gives the clinician an opportunity to demonstrate some of the principles which he has established, and certainly has some merit.

There is no actual measure by which we can evaluate educational efforts. The results of refresher courses in children's dentistry are, I believe, many and far-reaching. In Georgia, there has been much tangible evidence that we accomplished our objectives. In the five centers, 220 people attended. The many letters of appreciation sent to the state department of health were also appeals for additional refresher courses.

In general, the results that we may expect from refresher courses are as follows:

1. Dentists receive new inspiration as regards children's dentistry and a new attitude toward the work.

2. New and improved methods in the practice of children's dentistry are learned.

3. In the eyes of the dentist, the public health workers and the public, children's dentistry and preventive dentistry assume a more important place.

4. Through such programs, which are cooperative efforts of the dental association and public health department, dentists are made to feel that they have an important part in the promotion of public health; and since the public health program is primarily preventive, through such a relationship more and more emphasis will be put on preventive dentistry.

5. The publicity accompanying the refresher course is an education for the public and for the school. Both are reminded of the importance of children's dentistry and of the fact that their local

dentists are interested in children's dentistry.

CONCLUSIONS

1. Refresher courses in children's dentistry which have as their first objective assistance to dentists in the management of children and technic of children's dentistry can, if properly planned, improve public health and education programs.

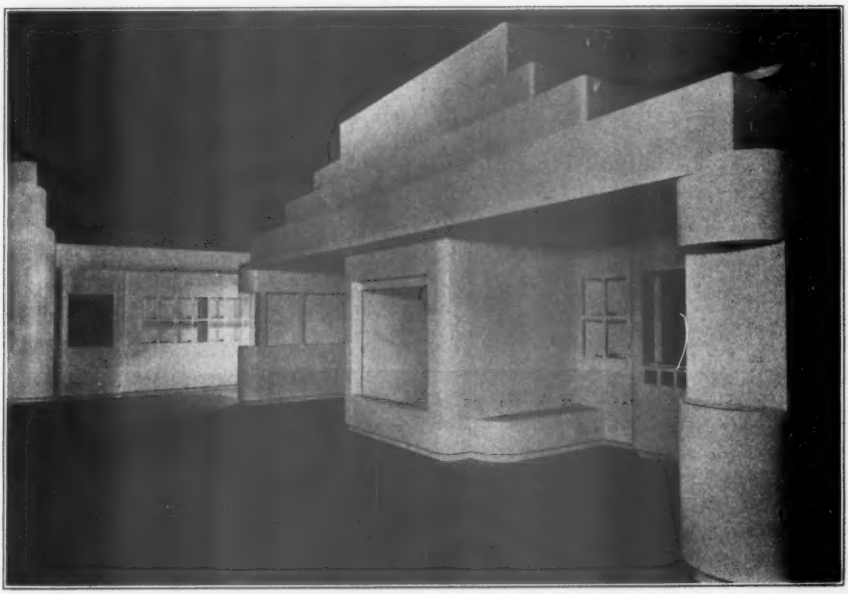
2. The center of interest in the organization of refresher courses should be the dentist who is not in sympathy with children's dentistry, or who has not had the opportunity to avail himself of the latest information on children's dentistry.

3. Refresher courses in children's dentistry are serving a great need in the dental and public health professions. Therefore, the American Association of Public Health Dentists should adopt resolutions concerning their continuation and expansion. Copies of resolutions should be sent to Dr. Cady and the public health authorities.

NATIONAL DENTAL HEALTH POSTER CONTEST PRIZE WINNERS

THE 1938 National Dental Health Poster Contest closed with a bang at the St. Louis meeting last October, gone but not forgotten, especially by the fifteen children who were finally selected as national prize winners.

Competing in a field of 500,000 contestants, these fifteen won in the local, the



Dental exhibit for Golden Gate Exposition, showing cases and shell, near completion, November 6, 1938.

state and finally the national contest. The winners are to be congratulated on their achievement.

The following acted as judges in the final contest: Dr. Harry Bear, Richmond, Va.; Dr. Frank C. Cady, Washington, D. C.; Mr. Paul Valenti, St. Louis, Mo.; Mr. L. M. Mitchell, of the American Red Cross, St. Louis, Mo., and Miss Rebecca Fisk, representing the U. S. Children's Bureau, Washington, D. C.

So keen was the competition that the judges had great difficulty in making their selection. As a result, 127 posters were given honorable mention.

First prize winning poster for vocational schools; by Josie C. Bruno, New Orleans, La.

Apparently no one state or section of the country has a corner on poster art work as nine states were represented by the fifteen national prize winners. Thirty-two states were represented in the honorable mention class.

Photographs of the first prize winning posters in each of the five divisions and the artists who made them appear together.

The second and third prize winners will appear in the February and March issues.

Following is a list of the winners and runner-ups:

RURAL

1st prize—Robert Stutzman, Johnstown, Pa.
2nd prize—Laurine Kucera, Hutchinson, Minn.
3rd prize—Annie Sampson, La Conner, Wash.

Josie C. Bruno, New Orleans, La., first prize winner for vocational schools.

ELEMENTARY

1st prize—Bessie Knight, Oklahoma City, Okla.
2nd prize—Lloyd Wandersee, 3131 Oregon Ave., St. Louis, Mo.
3rd prize—Raymond Becker, Uniontown, Pa.

JUNIOR HIGH

1st prize—Vivian Custer, Peoria, Ill.
2nd prize—Mary Susan Glenn, Columbia, Mo.

3rd prize—Helen Kahl, Fall River, Mass.

SENIOR HIGH

1st prize—Jack E. Satterfield, Altoona, Pa.
2nd prize—Richard Kahdeman, 3227a Itaska Ave., St. Louis, Mo.
3rd prize—Frank Katus, Peoria, Ill.

VOCATIONAL

1st prize—Josie C. Bruno, New Orleans, La.
2nd prize—Ferrel Daniels, Knoxville, Tenn.
3rd prize—Jack McNiff, 5342a Geraldine Ave., St. Louis, Mo.

Jack E. Satterfield, Altoona, Pa., first prize winner for senior high schools.

RUNNER-UP POSTERS
RURAL

Evelyn Hood, Isabel, Ill.
Paul Dennison, Isabel, Ill.
Leo Thilges, Bode, Iowa
Lloyd Lunter, Everest, Kan.
Anna Marie Peterson, Waynesville, Mo.
Mildred Bounds, Hannibal, Mo.
Betty Grubb, Missoula, Mont.
Floyd Schroeder, Oxford, Nebr.
Doris Hall, Lamar, Nebr.
Betty Futscher, Box 225, Larimer, Pa.
Rosella Kennedy, Okobojo, S. D.
Margaret Ann Breakey, R.F.D., Bellingham, Wash.
Mary Lou Colby, Bellingham, Wash.

ELEMENTARY

Mary George Besaw, 1120—8th St., Tuscaloosa, Ala.
Joe Moore, Tuscaloosa, Ala.
Peggie Gerard, 100 Scott, Little Rock, Ark.
Alex Aquilar, Hanford, Calif.

First prize winning poster for senior high schools; by Jack E. Satterfield, Altoona, Pa.

Junior Claywell, Colorado Springs, Colo.
Angelo Savo, 104 William Street, New Haven, Conn.
Edward Tomas, George Sumimoto and Earle Nakaji, Hilo, T. H.
Ethel Kakaza, 1203 Palamea Lane, Honolulu, T. H.
Michiko Sakai, Hilo, T. H.

Don Campbell, 1034 E. Moore, Decatur, Ill.
Leon Teague, Peoria, Ill.
Myron Willer, Peoria, Ill.
Betty Kohler, Pardeeville, Wis.
Charleen Chrisler, Lodi, Wis.
Neva Sharples, 539 Pomeroy, Clay Center, Kan.
Mildred Riggs, 116 West 7th Street, Hays, Kan.
Elizetta Ashley, Paducah, Ky.
Eldridge Hughes, 5811 Royal St., New Orleans, La.

First prize winning poster for rural schools; by Robert Stutzman, Johnstown, Pa.

Annie Laurie Alexander, Alexandria, La.
Richard Kline, Brunswick, Md.
Antoine Souza, New Bedford, Mass.
Frank Teixeira, 128 Nash Road, New Bedford, Mass.
Richard Duffy, Salem, Mass.
Elaine Sroka, 502—4th St., S., Moorhead, Minn.
Maryetta David, Montgomery, Minn.
John Engles, Batesville, Ark.

Burdette Nicholson, Beaver City, Nebr.
Helen Hansen, Lincoln, Nebr.
Mary C. Maier, Woodbury, N. J.
Constance Lucinio, 41 Conrad Street, Trenton, N. J.
Leo Storch, 315 West Broadway, Long Beach, N. Y.
Marie Vasquez, Sea Cliff, Long Island, N. Y.
Carol Hosler, 38 Highland Avenue, Mansfield, Ohio
John Schwartz, Mansfield, Ohio
Regina Power, 922 Iowa Avenue, Chickasha, Okla.
Joan Gority, Altoona, Pa.

Robert Stutzman, Johnstown, Pa., first prize winner for rural schools.

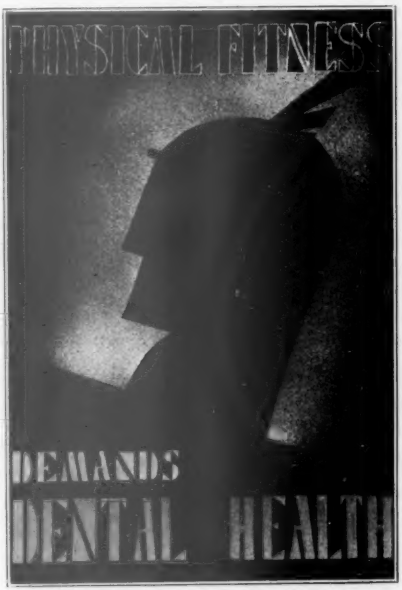
Claude Dunlop, 625 So. Maple, Watertown, S. D.
Leonard Schmidt, Redfield, S. D.
Betty Winters, 722 West Avenue, Madison, S. D.
Ray Hadley, R.F.D. No. 2, Ogden, Utah
Robert Buck, 1206 Staunton, N. W., Roanoke, Va.
Ruth Gentry, Crumpler, W. Va.
Eugene Hughes, Bellingham, Wash.
Betty Shoemaker, Batesville, Ark.

JUNIOR HIGH

Sam Kinney, Fort Smith, Ark.
George Fowler, Hanford, Calif.
Higashi Yokoyama, 410B Ohe Lane, Honolulu, T. H.
Lucy Gabriel, 1154 Desha Street, Honolulu, T. H.
Leilani Alamo, 1316 Liliha Street, Honolulu, T. H.
Katherine Lenchanko, 1642 Palamo Street, Honolulu, T. H.
Louise Waters, Peoria, Ill.
Harvey Seavey, Route No. 3, Box 622, Aurora, Ill.

Vivian Custer, Peoria, Ill., first prize winner for junior high schools.

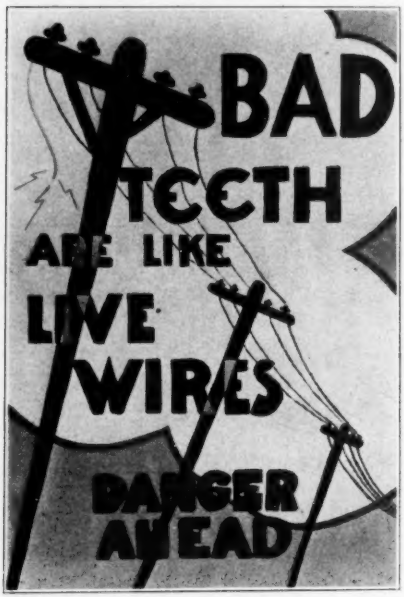
Peggy O'Donnell, Aurora, Ind.
Margaret Lanaghan, 736 Charlotte Avenue, Davenport, Iowa
Mary Jo Anderson, 1711 West Pleasant Street, Davenport, Iowa
Mary Frances Craig, 1415 O'Byrne Street, Henderson, Ky.
Betty Lee Nave, 1419 Breckenridge, Owensboro, Ky.
Alexandria Peters, 9 Central Street, Haverhill, Mass.
Winifred Lyman, 5 Fowler Street, Salem, Mass.
Ruth Vik, Wadena, Minn.
Stuart Ferreira, 4707 Jay Street, Duluth, Minn.
Bobby Johnson, Harvey Hotel, Helena, Mont.
Marion Peters, 436 S. 5th Street, W., Missoula, Mont.
Dorris Willard, California, Mo.
Marjorie Hoffmeister, 3880 Meramec Street, St. Louis, Mo.



First prize winning poster for junior high schools; by Vivian Custer, Peoria, Ill.

James T. Drumm, 2323 Morris St. (city and state unknown)
Corinne Guelker, 3880 Meramec Street, St. Louis, Mo.
Hazel Tracy, 30 Morse Street, Camden, N. J.
Edmund Matrejek, Linden, N. J.
Virginia Chalfant, 49 Nottingham Road, Rockville Centre, N. Y.
Norma Klausmier, Oklahoma City, Okla.
John Manis, Oklahoma City, Okla.

Bernetta Kubelis, 911 Kelleramn Ct., Scranton, Pa.
Harriet Lenker, York, Pa.
Lois Myra White, 40 North Eighth Street, Reading, Pa.
Ellen Bauer, R.D. No. 1, Royersford, Pa.
Maxine Hermanson, Rapid City, S. D.
Halvard Davidson, 2849 Adams Avenue, Ogden, Utah
Lillian Smith, 3003 Grant, Ogden, Utah
Wilbert Sowers, 314 Eighth Street, Princeton, W. Va.
George Munson, Washington, D. C.



First prize winning poster for elementary schools; by Bessie Knight, Oklahoma City, Okla.

Betty Jane Wendorf, Route 4, Box 13, Beaver Dam, Wis.
Margaret McKenney, Birmingham, Ala.

SENIOR HIGH

Dorothy McLane, Tuscaloosa, Ala.
Jack Mills, Tuscaloosa, Ala.
Margaret Poole, Ralph, Ala.
Wanda Elouise Drilling, 206 North Railway Ave., Morrilton, Ark.
William Bartell, 4 Jewel Street, New Haven, Conn.
Marie Swendsen, Bridgeport, Conn.
Unke Sadoyama (city and state unknown)
John Benko, Peoria, Ill.
Bernice Greve, Peoria, Ill.
Charlotte Och, 3648 N. St. Louis Ave., Chicago, Ill.
Bob Galligan, 1827 South Boots Street, Marion, Ind.
Betty Schwartz, Burlington, Iowa
John Parks, 121 So. Dodge, Wichita, Kan.

Bessie Knight, Oklahoma City, Okla., first prize winner for elementary schools.

Billy Caplinger, Frankfort, Ky.
Hughes Ingstrom, Marye Street, Alexandria, La.
Gladys E. Poenack, Fairhaven, Mass.
Deborah Sklover, Salem, Mass.
Irene Ruane, Salem, Mass.
Mary Ann O'Neill, 613 Walnut Street, Newtonville, Mass.
John Tarr, St. Paul, Minn., and Herbert Lyon, St. Paul, Minn.
Albert C. Brixius, 253—28 Avenue North, St. Cloud, Minn.

Alice Johnston, Missoula, Mont.
Mary Pavlick, Anaconda, Mont.
Newman Myrah, 205 Fourth Street, Deer Lodge, Mont.
Bill Masemore, 902½ Main Street, Trenton, Mo.
Dewey W. Harrison, Hannibal, Mo.
Yvonne Wisman, Lincoln, Nebr.
Vera Bouerle, Imperial, Nebr.
Audrey Boyles, 239 Point Street, Camden, N. J.
Jeanne Urich, 196 Sherman Avenue, Trenton, N. J.
William Caspersen, 78 Hartwell Place, Woodmere, N. Y.
Leslie Thompson, Jr., Oklahoma City, Okla.
Orville Garrett, Abington, Pa.
Harold Vanderlin, 513 No. French Avenue, Sioux Falls, S. D.
Hazle N. Lashwood, 155 Nebraska Ave., S.W., Huron, S. D.
Mary Gibson, 378 Washington Avenue, Roanoke, Va.
Katherine Bosang, 1706 Melrose Ave., N.W., Roanoke, Va.
Evangeline Reightler, 1714 Melrose Ave., N.W., Roanoke, Va.
Philip Stoddard, 2838 Franklin St., Bellingham, Wash.
Mary Darby, Bellingham, Wash.
Arline Mae Murk, 1813 C Street, Bellingham, Wash.
Harold Gooding, 216 E Street, N.E., Washington, D. C.
Lorraine Koontz, 1221 Jefferson Street, Washington, D. C.
Mary Jean Pearman, 225 Tenth Ave., Huntington, W. Va.
Mary Katherine Cook, 1201 Mercer St., Princeton, W. Va.
Barbara Knight, Superior, Wis.
Katherine West, Birny Star Rte., Sheridan, Wyo.
Patricia Heath (city and state unknown)

VOCATIONAL

William A. Lesko, 385 Ridgefield Ave., Bridgeport, Conn.
Harry P. Johnson, 727 King St., Stratford, Conn.
Warren Dontigney, Meriden, Conn.
D. Nelson, Jacksonville, Ill.
Harold Burris, Jacksonville, Ill.
Rita Marie Volk, Jacksonville, Ill.
Don Rosenberg, 241 S. Main, Henderson, Ky.
Marcelle Boucree, 727 Carondelet St., New Orleans, La.
June Manske, St. Louis, Mo.
Meyer Roland, St. Louis, Mo.
Steve Dressler, Cincinnati, Ohio
Elvera Kathman, 1641 Pulte St., Cincinnati, Ohio
Richard Funk, Cincinnati, Ohio

SCIENTIFIC AND HEALTH EXHIBITS AT ST. LOUIS

QUANTITATIVELY and qualitatively speaking, the Scientific and Health Exhibits at the St. Louis meeting of the American Dental Association were the best in its history.

Dentistry is deeply indebted to the 125 exhibitors who contributed so generously of their time, money and energy in making the exhibit section successful. Practically every phase of dentistry was presented and many branches of kindred sciences were well represented.

Because of the uniformly high quality of the exhibits, the judging committee had great difficulty in selecting the prize winners. The capacity of the large convention hall was strained to the utmost to accommodate the exhibit section.

In accordance with a plan adopted by the Board of Trustees in 1937, awards

First award, Division A, Scientific and Health Exhibits at the Annual Session of the American Dental Association, St. Louis, Mo., 1938. Ray F. Goering, D.D.S., Duluth, Minn., exhibitor.

First award, Division B, Scientific and Health Exhibits at the Annual Session of the American Dental Association, St. Louis, Mo., 1938. Columbia University, School of Dental and Oral Surgery, New York City, exhibitor.

are granted exhibitors on the following basis:

Exhibits in Class A are to consist of presentations of individual and original investigations. Exhibits in this class are to be judged on the basis of originality and excellence of presentation.

Exhibits in Class B need not represent purely original research or scientific study. They must represent originality in the correlation of facts, and for the improvement of technics which will help the practitioner. Exhibits in this class are to be judged on their value to the profession and the excellence of their presentation.

Exhibits in Class C are to consist of health educational projects. These are to be judged on their subject matter and the excellence of their presentation.

This year's awards were won by:

Class A:

1st place, Ray F. Goering, Duluth, Minn.

2nd place, Charles G. Grover and Miss Rosemary Kallminzer, Denver, Colo.

Class B:

1st place, Columbia University, School of Dental and Oral Surgery, New York City.

2nd place, Claude R. Wood, Knoxville, Tenn., Russell E. Irish, Pittsburgh, Pa., and Oren A. Oliver, Nashville, Tenn.

Class C:

1st place, North Carolina State Board of Health, Division of Oral Hygiene, Raleigh, N. C.

First award, Section C, Scientific and Health Exhibits at the Annual Session of the American Dental Association, St. Louis, Mo., 1938. North Carolina State Board of Health, Division of Oral Hygiene, Raleigh, exhibitor.

2nd place, Illinois State Department of Public Health, Division of Dental Health Education and Illinois State Dental Society, Springfield, Ill.

Illustrations of the first prize winning exhibits are shown herewith. Illustrations of the second prize winners will be shown in the February issue of THE JOURNAL.

DENTAL ECONOMICS

PUBLIC ASSISTANCE: THE PLAN IN OPERATION IN THE COMMONWEALTH OF PENNSYLVANIA

As the result of a study made by a commission set up by the governor of Pennsylvania in December 1935, the entire question of public relief in the state comes under the following plan.

Seven recommendations proposing a sweeping reorganization and consolidation of all forms of public assistance under state supervision with local control were made. Major recommendations called for permanent relief, and the consolidation of its supervision, together with that of other assistance services (medical care), in a new state department to be known as the Department of Assistance.

Of equal importance from the viewpoint of the taxpayer was the recommendation that the state's 200 year old poor board system, supported by a direct tax on real estate, be abolished, and that all forms of assistance in the home be financed by the state through budgeted appropriations.

In the past, owing to the entrenchment of the state's 425 poor boards, represented by nearly 1,000 office holders, efforts have been directed toward reform rather than fundamental change. Progress that was made was in the form of withdrawals of responsibility, as in the case of the Mother's Assistance Fund, in 1913, and, more recently, the establishment of old age assistance and blind pensions. The establishment of the state emergency relief board in the summer of 1932, through which all state and federal funds for unemployment relief were spent until the adoption of the present plan on January 1, 1938, admitted failure of the old system.

THE RECOMMENDATIONS

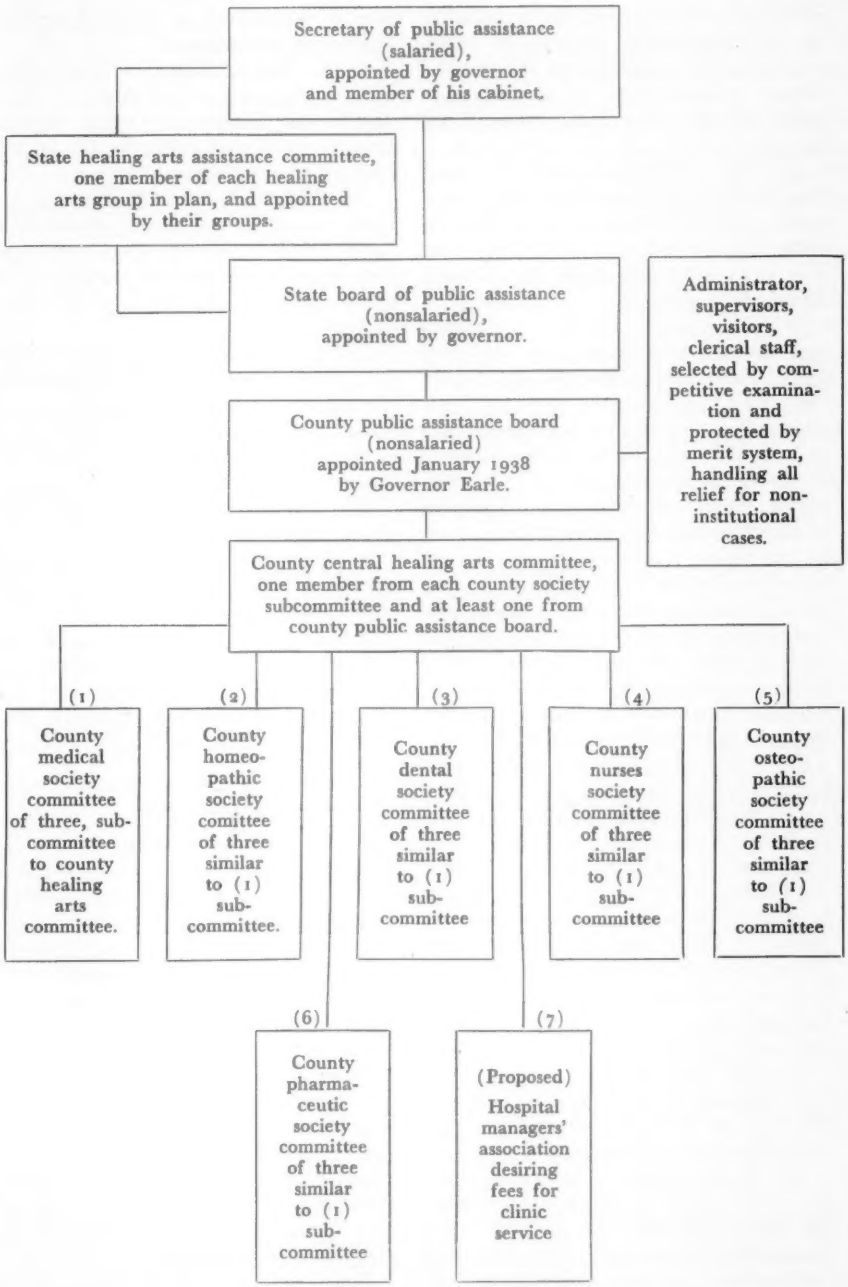
It was recommended that:

1. A state-wide program of public assistance and relief suitable to the present need and adjustable to changing conditions in the future be maintained in Pennsylvania.

2. Pennsylvania's program of public assistance of needy persons at home including general poor relief, unemployment relief, aid to dependent children in their own homes (known as Mother's Assistance) and in foster homes, old age assistance and aid to the blind be unified and simplified and be administered through a single public organization in each county, subject to supervision by a single permanent department of the state government.

3. Locally administered public assistance of individuals and families be supervised and standardized by the state government through a new department of assistance.

4. (a) Direct administration of general outdoor relief, unemployment relief, aid to dependent children in their own homes (Mother's Assistance) or in foster homes, old age assistance and aid to the blind be under the immediate direction of a county board of assistance in each county, composed of representative citizens of the local community, serving without pay except for necessary ex-


Secretary of public assistance (salaried), appointed by governor and member of his cabinet.
State healing arts assistance committee, one member of each healing arts group in plan, and appointed by their groups.
State board of public assistance (nonsalaried), appointed by governor.
Administrator, supervisors, visitors, clerical staff, selected by competitive examination and protected by merit system, handling all relief for non-institutional cases.
County public assistance board (nonsalaried) appointed January 1938 by Governor Earle.
County central healing arts committee, one member from each county society subcommittee and at least one from county public assistance board.
(1)
County medical society committee of three, subcommittee to county healing arts committee.
(2)
County homeopathic society comittee of three similar to (1) subcommittee.
(3)
County dental society committee of three similar to (1) subcommittee
(4)
County nurses society committee of three similar to (1) subcommittee
(5)
County osteopathic society committee of three similar to (1) subcommittee
(6)
County pharmaceutic society committee of three similar to (1) subcommittee
(7)
(Proposed)
Hospital managers' association desiring fees for clinic service

penses and charged with the responsibility for determining policies of public assistance to be applied in the county, subject to minimum standards established by the state department of assistance.

(b) The Mother's Assistance Fund boards, the Old Age Assistance Fund boards and the Emergency Relief boards, where they existed, be abolished and their functions be taken over by County Boards of Assistance.

(c) The county, district, township and borough poor boards be abolished immediately and their powers, duties, rights and privileges with respect to outdoor relief and the care of dependent children be transferred to the County Board of Assistance, and their powers, duties, rights and privileges with respect to almshouses and other institutional care be transferred to the county commissioners of the county, who shall be charged with ultimate residual responsibility, now lodged with the poor districts, to provide assistance for such needy persons as may fail to receive aid from other sources.

5. (a) The financial cost of public assistance in all the forms to be administered by the county boards of assistance be assumed by the state.

(b) Specific appropriations be made to the state department of assistance for each form of public assistance, and that an additional appropriation to a reserve fund be made to the state department of assistance, which can be allocated to any one of these funds or to the payment of necessary additional services undertaken by county boards of assistance in accordance with the law.

(c) The state laws be amended to assure assistance with federal aid for the Mother's Assistance Fund, the Old Age Assistance Fund and the blind.

(d) Public assistance be administered in such a way as to afford every possible incentive to beneficiaries of aid to strive to regain their power of self-maintenance and to discharge their proper responsibilities to themselves, to their dependents and to the community.

6. (a) The requirements for determining the eligibility of individuals or families for aid among the various types of assistance be standardized as far as possible in administration.

(b) The basis of eligibility for all forms of assistance to be administered under the new county boards of assistance be as nearly alike as possible for all services; namely, the actual need of assistance.

(c) The amount of the grant available to any eligible dependent person be the extent of his need, established in accordance with administrative regulations of the state department of assistance, allowing for fluctuations in living costs.

(d) The present plan of providing assistance or relief in cash be continued.

(e) A program for necessary medical care be included among the services provided to dependent persons.

7. All officers and employes in the state department of assistance, other than those in policy determining positions, and all officers and employes under all county boards of assistance be placed under the Merit System.

MEDICAL CARE

When the investigating committee undertook its projected study of the general relief problem, a systematic medical relief program was in operation in one branch of public assistance only; namely, unemployment relief. This program enlisted the advice and administrative cooperation of professional groups in the principal fields of the healing arts.

When the medical relief program of the Pennsylvania Emergency Relief Board was abandoned in September 1936, a special advisory committee, consisting of delegated representatives of the professional groups and associations concerned with the healing arts, was created to discharge this responsibility.

The plan and scope of the study un-

dertaken cooperatively by the Special Medical Advisory Committee and the Pennsylvania Committee on Public Assistance and Relief (the original commission) were determined by two main objectives:

1. To discover as quickly and fully as possible the extent of the need for medical relief in Pennsylvania and the available facilities and methods for meeting those needs. This necessarily included a study of the incidence of illness or of need of health treatment among those receiving other forms of public assistance and those on the borderline of economic dependency whose own payment for necessary health service might bring them into the relief group. It required also an analysis of available information on medical relief programs, both the recently discontinued Pennsylvania Emergency Medical Service for the unemployed and other experiments which had preceded or followed it.

2. To recommend the scope and basic conditions, as well as the approximate cost, of a suitable and adequate program of medical care for these groups of persons in Pennsylvania.

CONCLUSIONS AND RECOMMENDATIONS

1. Medical care (services of the healing arts professions) is an integral and indispensable part of any sound program for the public relief and assistance of persons unable to maintain themselves at a minimum level of health and decency.

The conservation of public health and the promotion of the general welfare justify provision of adequate medical care of those in need as an obligation of government. Governmental responsibility exists in the same measure for members of families when they become ill as when they are well, and illness, which inaugurates a more expensive and difficult condition, does not alter or diminish this governmental responsibility.

2. A state-wide service for this purpose should be provided, designed to meet, as nearly as possible on an equal basis, the needs of all such persons.

Many of the smaller divisions and subdivisions of the state, if left to their own resources and initiative, not only would be financially unable to set up and maintain an adequate health service for those in need, but also would create a hodgepodge of services which would often be extravagant, overlapping and inefficient.

The medical relief program should be supervised by the department of the state government which will administer general relief, but it should be so organized as to leave a wide latitude of administrative freedom, under the supervision of the healing arts professions.

3. Such a program should, as far as possible, serve:

(a) Those receiving other forms of public assistance.

(b) Other persons certified by the county assistance boards as unable to provide for themselves such necessary services as are included in the program.

The right of all these persons to receive public aid, by reason of their economic status, has been established by investigation. As it has been proved that they are financially unable to provide themselves with other basic necessities of life, such as food and shelter, it is obvious that they will be unable to pay for medical attention when sick. For estimating the problem of this group, a great deal of factual information is available. They have been counted and studied by many agencies and organizations for years.

In the economic group just above this level are many persons who are living on the lowest subsistence basis. These persons are on the borderline of independence. They are just able to maintain themselves without help at a level of existence which the standards of public assistance organizations accept as tolerable. Their position is a precarious one, however. Any misfortune upsets their

balance and they quickly fall back into dependency. When illness strikes such a family, especially if it affects the breadwinner, the members are unable to provide themselves with the necessary medical attention, and unless some provision is made to supply it to them, they will soon increase the rolls of those on relief. These persons should not be classified as "sick poor people," but people who are "poor when sick." The number and extent of the "borderline" class of persons is unknown. It is a relatively uncharted field. In planning to include them in a health program designed for the indigent, it is realized that the problem of care and of cost is largely increased.

In spite of these difficulties, it is, nevertheless, considered necessary and desirable to make provision for their care when sick, in order to enable them to maintain their economic independence. It is believed that these persons could apply and be certified for medical attention alone, after a routine social and economic investigation by a relief agency. This procedure would serve to prevent abuses and also to make it possible in time to obtain factual information on which more definite plans could be made hereafter for this group.

At any rate, it seems foolish to require such a person to establish his inability to provide himself with some other necessity of life, such as food, shelter and clothing, before being entitled to receive medical care. Such a policy provides an inducement for joining the relief rolls and for sacrificing all economic independence. Furthermore, it is this borderline class of persons who are most neglected from a health point of view. Provisions for sickness have often been provided for the definitely indigent, and financially independent persons will provide it for themselves. The person on the borderline is working and making an effort to keep off the relief rolls, and should be helped.

4. This program should, as far as possible, supply a complete service including:

(a) Preventive service, utilizing, in this connection, regular health agencies.

(b) Corrective and curative service, including medical, dental, nursing, clinical, hospital and pharmaceutic services.

A health program in order to be of real value either must itself take care of all phases of illness and disability or must be correlated with other organizations supplying necessary services. It should be the aim of a health program to recognize and utilize all existing health activities, such as those of the state and local departments of health, the United States Public Health Service, public rehabilitation services and others, only entering the field of work covered by these departments when it is absolutely necessary to fill a gap.

The dental profession, represented by the Pennsylvania State Dental Society, desires the opportunity to work out with the state department of assistance a plan that will provide:

(a) Adequate service for children.

(b) Emergency service for adults, with the provision for supplying restorative work when authorized by the county board of assistance.

The dental profession believes that there is no single program that can be applied with equal effectiveness to all parts of the state. For this reason, the profession will offer for consideration to the state department of assistance plans, made up in conjunction with the several county boards of assistance, that will best meet the situation peculiar to each local area.

In supplying dental service to children whose families are unable to purchase this aid, any program of public assistance in the health field should emphasize preventive measures and the early correction of dental disease.

Adults who may be returned to gain-

ful employment should receive a minimum of dental care, and that only for the relief of pain, the elimination of infection or such restorative dentistry as will aid in their return to gainful occupations. The determination of employability shall be made by the county board of assistance.

For those persons who are unemployable and in the opinion of the county board of assistance cannot be returned to economic society, a more complete dental service should be provided to insure comfort and safety to health.

5. The organizational framework of this program should be based upon the county unit of administration, with a liberal allowance of local autonomy in administration and experimentation.

6. The general scope, standards and forms of operation should be determined by the state, through the appropriate department.

7. The state office at Harrisburg should outline basic rules of operation for the program and the local county committees should supply the detailed procedures of operation which apply to their respective areas.

The professional groups should be consulted in deciding on the basic rules. Provisions should be made for changing the rules in the future, if necessary, without involving too many tedious and complicated procedures. Such a project as this complete medical program is still in an experimental state and it is impossible to be sure that any set of rules accepted today will meet the approval of administrative officers and committees in the future.

8. The program should provide, unless otherwise specified as the result of an agreement between the Department of Assistance and the professional group involved, for the free selection of licensed or registered physicians, dentists, nurses, hospitals, clinics, pharmacists or qualified organizations set up by, operated and controlled by the healing arts groups participating in this work.

9. Payment should be made on the fee-for-services principle, as far as practicable, and all necessary adjustments of bills should be made according to a predetermined plan.

10. All participating professional persons should be given the benefit of a hearing before their own professional group before any official disciplinary measures are enforced.

September 15, 1938, the medical care program was started after the necessary organization of the healing arts group had been accomplished. This consists of an advisory committee to the state public assistance board made up of one representative of each of the professional groups participating as well as similar committees in each county. Fee schedules were established. The checking of all invoices is done by the subcommittees and paid within two weeks by the state.

The accompanying diagram demonstrating the relationship between the component parts of the set-up in Pennsylvania is published because it is working satisfactorily to all concerned, and although at the present time medical care is being supplied only to those on relief, it can be expanded to include the so-called "borderline group." It is offered for study and consideration to all state groups where the need for such a program is indicated and possibly impending. It requires the cooperation of the other members of the healing arts group as well as the lawmakers. A complete report of the survey is filed with the Economics Committee of the American Dental Association.

R. M. WALLS, *Chairman,*
Economics Committee, A.D.A.

CURRENT LITERATURE

A Method for the Estimation of Ultramicroquantities of Lactic Acid

By Benjamin F. Miller and John A. Muntz

The method was developed to permit evaluation of the rôle of lactic acid in the pathogenesis of dental caries. The technic relies on the development of a blue coloration that is measured with a Pulfrich step photometer. It is applicable to carious tooth substance, serum and saliva. The optimum sensitivity of the method is in the range of 2 to 10 micrograms of lactic acid, although an estimation may be carried out with quantities as small as 0.1 microgram. The precision has been checked by determining the recovery of lactic acid added to various biologic substances and by comparison with another method. Duplicates are found to agree within from 2 to 3 per cent. The advantages cited for the procedure are its increased sensitivity and specificity, and its simplicity and brevity of operation.—*J. Biol. Chem.*, 126:413-421, November 1938.

Richard S. Manly.

Healing Time in Fractures of the Mandible

By C. C. Welch and R. W. Taylor

During the healing of a fractured mandible, where there is little movement and the fragments are not too widely separated, there is usually an absence of extensive peripheral callus such as is found in healing long bones. Nevertheless, after immobilization has been maintained for the required time, good union of the parts may be demonstrated. The authors believe that after a few weeks, there is only a fibrous union of the segments. They have observed that frequently several months or several years must elapse before evidence of the fracture line is completely obliterated in the roentgenogram.

They believe that healing time is greatly influenced by delay in reduction of the fracture, which should be eliminated as nearly as is possible, poor approximation of the fragments and insufficient fixation. Whenever possible, teeth included in the line of fracture should be removed prior to reduction. The observations indicate that the majority of infections resulting from fractures occur in cases in which teeth have been left undisturbed in the line of fracture.—*U.S. Naval M. Bull.*, 36:513-517, 1938.

Frank Allen.

Apicoectomy

By R. W. Taylor

The author makes no attempt to discuss the rationale of root canal therapy or to dictate the type of lesion in which his method is to be employed.

If the tooth to be treated is abscessed, several days are permitted to elapse until the acute symptoms have subsided. The tooth and those approximating it are isolated by a rubber dam, the lip is retracted and all exposed tissue is painted with iodine. A semilunar incision is made and the tissue and periosteum in the apical region are retracted. The root apex is removed through a window made in the bone, and surrounding infected material is curetted, a cavity being created which is tightly packed with iodoform gauze. The crown of the tooth is opened in the usual manner and the pulp canal is cleaned of organic material. The canal is sterilized and dried and a root canal filling inserted. The root stump is smoothed and is cauterized with silver nitrate. The bone cavity is touched with phenol, immediately followed by alcohol. The periosteum and gingival flap are sutured in place without a drain.

The author reports gratifying results and complete bone regeneration in the apical region.—*U. S. Naval M. Bull.*, 36:511-513, 1938.

Frank Allen.

Thymol Therapy in Actinomycosis

By T. M. Joyce

Although actinomycosis is widespread, occurring in all parts of the United States, it is most commonly found in the Mississippi Valley and in the Northwest. Its distribution

corresponds somewhat with that of the dairy industry and the association of man with cattle.

Once acquired by inhalation or ingestion, the disease may become acute, subacute or chronic. Its lesions tend to remain localized and spread only by direct continuity.

Although diagnosis can be made by tissue section, it is best and most easily made by examination of pus from a discharging sinus. The characteristic "sulfur granules" are readily recognized in (a) a fresh preparation, (b) a stain for mycelium and (c) cultures in various media.

Treatment has been voluminous, but questionable in value. The author describes good results from the following: oral administration of 1.5 gm. of powdered thymol two out of every three days. The sinuses are widely opened, curetted and filled with a 10 per cent solution of thymol oil. The sinuses are injected each day, being kept opened by the insertion of small strips of gauze. Several case reports are given.—*Ann. Surg.*, 108:910-917, 1938.

FRANK ALLEN.

Facial Neuralgia

By H. H. KENSHOLE

NEURALGIA, pain in a nerve, may be a symptom of irritation of nerve-endings, trunks of nerves, ganglia on the course of nerves or central nervous tissue. Pain of similar character may be complained of by patients with mental afflictions, those suffering from neurasthenia or neuroses. No pain should be labeled "psychalgia" until every possible physical cause or demonstrable pathologic lesion has been eliminated.

The author describes and differentiates neuralgia from dental and that from non-dental conditions. Among those discussed are: dental neuralgia, paroxysmal trigeminal neuralgia, migrainous neuralgia, sinusitis, herpes zoster and glossopharyngeal tic.—*Clin. J.*, 67:456-458, 1938.

FRANK ALLEN.

Treatment of Cancer of the Tongue

By V. P. BLAIR, J. B. BROWN and L. T. BYARS

THE authors believe that most cases of cancer of the tongue get beyond five-year control for one, or several, of the following reasons: 1. Failure of the examining physician to recognize obvious cancerous or precancerous lesions. 2. Misinterpretation of the microscopist's statement that "no cancer was found" as meaning that the patient has no cancer. 3. Failure to impress cancer patients with the importance and high average success of standard methods of early treatment and the fact that inadequate treatment entails a 100 per cent death rate. 4. Failure of the therapist to recognize what is needed or an attempt at procedures beyond his skill in still controllable cases.

Among the local findings, there are three which, in combination, should bring strong suspicion, if not a positive diagnosis, of epithelioma: chronicity, which may have gone unnoticed, induration and early ulceration. Individual lesions may appear variously.

Clinical diagnoses should be checked by biopsy. If the microscopic findings are at variance, with carefully observed characteristic findings, it is much safer to credit the clinical diagnosis. Biopsy material may contain no part of the true growth.

The authors include a number of case reports, therapeutic measures and statistics derived from their observations.—*Surg. Clin. N. America*, 18:1255-1274, 1938.

FRANK ALLEN.

Lipoma of the Tongue

By M. PAUL

LIPOMAS of the tongue are comparatively rare. The author reports a case of pedunculated lipoma entirely covered with mucous membrane. It had been steadily increasing in size for twelve years. Removal was under local anesthesia. Postoperative measurements showed the neoplasm to be about 2 inches long and the weight approximately 6 ounces. —*Lancet*, 2:997, 1938.

J. VOLKER.

Treatment of Dangerous Reactions to Novocain

By SAMUEL GILMAN

THE author classifies dangerous reactions to novocain under three headings. The first and most frequent type is one that affects the central nervous system. Delirium, convulsions and respiratory failure are not uncommon findings. These attacks are

frequently of long duration. The second type follows immediately administration of the drug. The symptoms are chiefly circulatory, including rapid pulse, fall in blood pressure, fainting and what seems to be sudden circulatory failure. The third type appears to be of a true allergic nature. Two cases of type one reactions were characterized by convulsions, respiratory failure and loss of consciousness. Automatic respiration returned two hours after the attack, but consciousness was not regained until six hours after the onset of the reaction.—*New England J. Med.*, 219:841, 1938.

J. VOLKER.

Systemic Reactions to Oral Fusospirochetosis Without Local Lesions

By W. H. BARROW

VINCENT'S infection is usually characterized by ulceromembranous inflammation of the oral mucous membrane. The author presents a series of cases with minimal or no recognizable local lesions, but with definite generalized symptoms. In all cases, smears from around the teeth show moderate or heavy invasion of spirochetes. The generalized symptoms usually found included malaise, indigestion, occipital and cervical neuralgia, sore throat, sensitiveness of the teeth and secondary anemia. All cases respond to the usual local treatment for Vincent's infection. The author recommends the use of arsenicals and complete dental prophylaxis to combat the condition.—*Ann. Int. Med.*, 12:508, 1938.

J. VOLKER.

Sialography, Its Technique and Application in the Roentgen Study of Neoplasms of the Parotid Gland

By J. BLADY and A. HOCKER

X-RAY studies of various pathologic conditions of the parotid gland were made by injecting Stenson's duct with lipiodol. From 1 to 1.75 cc. of this iodine compound was injected slowly with a 2 cc. tuberculin syringe fitted with a 20-gage, 3-inch blunt needle. The duct system was then x-rayed from lateral and anteroposterior positions. The lipiodol was usually removed by the gland in from one to three days.

Seventy-six tumors, including twenty-four carcinomas, were studied by the authors, who conclude that roentgenographic changes caused by tumor infiltration are diagnostic of carcinoma. The x-ray findings are described in detail. Twenty-six references are given.—*Internat. Abstr. Surg.*, December 1938, p. 552.

MARTIN DEAKINS.

Dental Tissues in Osteitis Deformans

By M. RUSHTON

THREE teeth from a case of osteitis deformans were studied histologically. The pulp of two molars had been replaced by secondary dentin containing a few tubules. Both exhibited hypercementosis, in one excessive. The apical cementum was poorly differentiated. The changes in the cementum were comparable with those in bone and were contrasted with the findings in a case of localized osteitis fibrosa.—*D. Record*, 58: 611, 1938.

MARTIN DEAKINS.

Tuberculosis of the Lip

By C. STAHLER

PRIMARY tuberculous ulcerative lesions of the lip are rare. The author finds only thirty cases reported in the literature and reports two from his own clinic.

There are no distinctive clinical symptoms. The lesions may occur at any age, in any location, with or without pain, and be acute or chronic. Biopsy is the only certain method of diagnosis.—*Am. J. Surg.*, 42:419, 1938.

MARTIN DEAKINS.

Tumors of the Mouth and Jaws

By K. H. THOMA

THIS review classifies and describes tumors of the mouth, as of (1) osteogenic, (2) odontogenic and (3) nonosteogenic and nonodontogenic origin and as (4) lesions of the soft tissues of the mouth.

One hundred and twenty-five references to the literature are given.—*Internat. Abstr. Surg.*, December 1938, p. 552.

MARTIN DEAKINS.

Three Cases of Brown Coloration of the Enamel of All Teeth

By JOHAN RYGGE

THE author presents three cases in which all the surfaces of all the teeth showed a yellowish red to brown coloration of the enamel. A histologic study shows that the enamel only is affected. It is further revealed by the porosity of the enamel to diamant fuchsin stain. A spectographic examination of the

enamel showed a copper content of 0.01 per cent, which probably accounts for the discoloration. The teeth gave no evidence of caries and the condition did not appear to be hereditary. Medical examinations were negative.—*Den Norske Tannlaegefor. Tid.*, 48:607, 1938.

S. B. Finn.

Human Requirements of Vitamin C

By Sybil L. Smith

The author discusses three methods of determining the state of vitamin C nutrition in human beings: (1) resistance or fragility of blood capillaries; (2) the excretion of ascorbic acid in urine, and (3) the content of ascorbic acid in fasting blood. On the basis of methods followed, three levels of requirement may be considered in terms of the minimum quantites of ascorbic acid required: (1) to prevent the slightest decrease in capillary resistance or to maintain uniform excretion of the vitamin barely above that on a vitamin C-free diet; (2) to maintain uniform excretion after a depletion period following a preliminary period, and (3) to maintain the tissues in a state of saturation as determined by various modifications of the test dose method. These levels of requirement may conveniently be termed the physiologically indispensable, adequate and saturation values, respectively.

The estimated requirements for various age groups as reviewed lie within the following limits of absolute values: infants, from about 8 mg. (newly born) to 50 mg. daily; children, from 22 to 100 mg., or more; adults, from 28 to 100 mg., or more. With due allowance for unlike methods followed in their determination, these values may be considered to represent roughly the range from the physiologically indispensable minimum to saturation. Values of about 20 mg. daily for infants, 40 mg. for children and from 50 to 60 mg. for adults may be considered as tentative estimates for the middle or barely adequate consumption level, with but little margin of safety or allowance for individual variations in requirement.

It has been stated that "saturation is the truly optimal state of ascorbic acid nutrition for the infant since in the event of an increased demand or decreased supply, the vitamin depot is presumably larger than in partial saturation." The same argument would seem to be valid for the growing child. Since vitamin C is intimately concerned with cellular metabolism, liberality in allowance throughout the entire period of growth seems logical. There is still considerable difference of opinion concerning the satisfactory allowance for the adult. While it may be safe to accept the middle level of requirement, the upper level is more in keeping with the policy of providing a generous margin of safety in most dietary allowances. In pregnancy and lactation, with their increased demands, the margin of safety afforded by the upper level of requirement is most essential, and this may also hold for elderly persons.—*J.A.M.A.*, 111:1753, November 5, 1938.

M. K. Hine.

Elimination of Bacteria from the Mouth

By J. L. T. Appleton, Henry Klein and C. E. Palmer

Little is known concerning factors in the elimination of micro-organisms from the oral cavity, although numerous observations have led to the assumption that mechanisms exist which do determine the kinds and numbers of bacteria present in the mouth. The authors report a study of a method which allows investigation of the rate by which bacteria are eliminated.

Varying numbers of *S. marcescens (B. prodigiosus)* were inoculated into three patients for a total of 590 times and cultures made at intervals after each inoculation. To determine the presence of the test organisms in the mouth, the mouth was rinsed for one minute with 2 cc. of water, 0.5 cc. of which was then transferred to beef extract bouillon and incubated.

It was found that *S. marcescens* eventually disappears from the oral cavity, and the larger the number of bacteria, the longer the time required for the bacteria to disappear. The experiment also shows that the rate of elimination varies with different individuals. No explanation is offered concerning the method by which the bacteria are eliminated, although one of the experiments shows that the presence of saliva in the mouth rinse has no effect on the results.—*Am. J. Hyg.*, 28: 213, 1938.

M. K. Hine.

INCIDENTS OF PRACTICE

A Cuspid and a Bicuspid Tooth with Two Root Canals

By S. E. Axelrod, D.D.S., Chicago, Ill.

Two teeth, a cuspid and a bicuspid, each having two root canals with bilateral divisions, are shown in Figures 1-2. The right cuspid also had two root canals. The

Figure 1.

Figure 2.

patient was a man, aged 50, having a history of hypertension, with heart and kidney involvement.

A Compound-Composite Odontome Containing Seventeen Small Teeth: Report of Case*

By Rose Iusem and Guillermo Ries Centeno, Buenos Aires, Argentina.

History.—A girl, aged 11, brought in for examination, had a clear space in the dental arch from the upper right lateral incisor to the second bicuspid, which had erupted in malalinement. Her parents and brothers were living and the family history was negative.

Examination.—There was much caries.

Fig. 1.—Odontome between central incisor and bicuspid teeth. The socket from which the lateral incisor has been removed is shown.

Fig. 2.—Teeth and enamel grains found in odontome.

The deciduous cuspid was in place, but not firm in the socket. The lateral incisor was abscessed. Both teeth were removed. There was a hard swelling or protuberance in the clear space about the size of a walnut. A bone-hardness could be felt on pressure and there was neither pain nor inflammation. The cuspid and first bicuspid area was oc-

*From the School of Odontology, University of Buenos Aires.

cupied by a large radiopaque body in which were several teeth. The cuspid and first bicuspid teeth were present, but were prevented from eruption by the odontome.

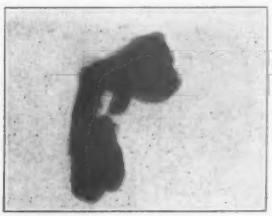
Operation and Outcome.—Surgical removal was advised and, under procaine infiltration anesthesia, a gum flap was made and the buccal bone plate removed with a chisel, the odontome being exposed. The bone plate was reduced in thickness. The odontome was surrounded in some parts by a fibrous membrane. Careful and complete curettement disclosed seventeen small separate teeth and enamel grains, of which about fifteen were distinguishable to the naked eye as complete teeth consisting of crown and root. Some had the appearance of cuspid teeth; some were decidedly malformed. The largest were of normal cuspid size and the smallest but a grain of enamel. The permanent teeth were not removed, nor was the vitality of the adjacent teeth destroyed. Recovery was uneventful.

Triunvirato 3029.

Tooth Fusion

By M. L. Levin, D.D.S., Southampton, N. Y.

The accompanying illustration is that of an upper left third molar in which the roots are fused with the roots of the upper second molar. The patient, a man, aged 37, complained of acute pain from the exposed pulp of the second molar and pressure pains shooting upward toward the ear and head.



Unilateral Dental Caries: Report of a Case*

By Webb B. Gurley, D.D.S., St. Louis, Mo.

In reviewing the dental literature, no case was found in which the teeth of one side of the mouth were badly affected by dental caries and the teeth of the opposite side caries free.

Because of the great interest in all phases of dental caries, report of such a case is presented.

REPORT OF CASE

History.—T. P., a woman, white, aged 20 years, weight 103 pounds, was referred to the School of Dentistry, Medical College of Virginia, by a general practitioner of dentistry for a study of the condition of her mouth. The patient gave a history of good health except for dental caries of the permanent teeth on the left side of the maxillary and mandibular arches since the time of their eruption. There was no report of pain and she expressed little concern about the condition of her mouth except for its appearance.

Fig. 1.—Freedom from caries on right side. Cuspids, bicuspids and molars were noncarious.

Fig. 2.—Caries on left side. All teeth were carious except a partially erupted maxillary cuspid and third molar.

*From the Department of Operative Dentistry, School of Dentistry, Washington University.

The diet was quite normal for this section of the country, as were the habits of gum chewing, etc. The general health and appearance of the patient were good.

Examination.—A complete intra-oral examination revealed a full complement of teeth. In the maxillary and mandibular arches on the right side of the oral cavity, cuspids, bicuspids and molars were entirely free of caries (Fig. 1), and these teeth were relatively clean and surrounded by normal healthy soft tissues. The flow of saliva from the glands of this side was less than for the average normal person of this age.

The corresponding teeth of the left side, with the addition of the incisors, were badly affected by caries (Figs. 2-3); the condition ranging from large compound cavities to destruction of the crowns. Two exceptions were a partially erupted maxillary cuspid and third molar. The broken down teeth were surrounded by hypertrophied tissue and débris. (Fig. 4.) Dysfunction of the parotid gland of this side was almost complete, and only a small amount of viscid fluid could be

Fig. 3.—Appearance of anterior teeth in occlusion.

Fig. 4.—Hypertrophied tissues and débris around broken-down teeth.

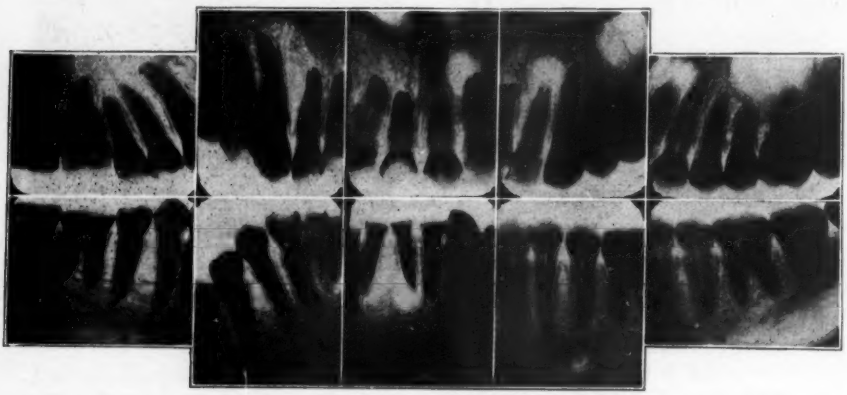


Fig. 5.—Roentgenograms confirming clinical findings and in addition revealing pulpless condition of badly broken-down teeth and diseased tissues.

expressed from the duct. There was no way of determining whether this salivary deficiency occurred before or after the onset of caries.

The entire mouth was very dry, producing barely enough moisture to saturate a 2-inch piece of litmus paper in a minute. The pH of the saliva in the region of each parotid duct was the same, 6.4.

The roentgenograms of all the teeth (Fig. 5) confirm the clinical findings with the addition of evidence that many of the badly broken down teeth are pulpless, with disease of the tissue surrounding their root ends.

There seems to be no explanation for this phenomenon except the possibility that the xerostomia may have been concerned.

Impacted Wisdom Tooth and Visual Complications

By Alexander Rosen, D.D.S., New York City.

A white woman, aged 32, who came in for a general examination of the teeth, complained of pain in the upper right molar area. Intraoral examination revealed the absence of the upper right third molar. The upper right second molar was carious. Prior to x-ray examination, the patient stated that she had been suffering with severe headaches and eye symptoms for the past five or six years. She had had her eyes examined yearly in an effort to obtain relief. She felt at times as though she was unable to see clearly with the right eye. These attacks occurred at regular intervals, several times a month over a long period of time. The pains were localized in the right orbital and frontal areas. Sedatives relieved the pain considerably. The ophthalmologist told her that the eye condition was negative. The most recent eye examination followed an unusually severe attack. X-ray examination of the upper right molar area revealed a vertically impacted third molar in a mesio-angular relationship with the upper right second molar. Since the impacted tooth was removed, and for a period of four months, there has been no sign of the previously experienced pain and visual defects.

Pathologic Fracture of the Mandible

By C. L. Miner, D.D.S., St. Cloud, Minn.

The interesting cases are, to dental practitioners, the unusual ones, and we all know that surgical cases do react differently.

In this particular case, both reactions were noticed after extraction—anabolism and katabolism.

A man, aged about 53, of sallow complexion, weight 170 pounds, reported March 28, 1936, for removal of an embedded lower right third molar. (Fig. 1, a.)

a b c d

Fig. 1.—a, condition before examination; b, March 30; c, May 27; d, June 24.

Urinalysis was negative; blood pressure, systolic 190, diastolic 150. The patient complained of fatigue and pain in the region of the liver. His physician ordered removal of all foci of infection. The removal of the tooth in itself was not difficult, but the bony process was extremely hard. The method used in extracting was sectional removal, by first removing the crown of the tooth and then elevating the root into the cavity formerly occupied by the crown. The socket was swabbed with metaphen and seemed to maintain a normal blood clot easily. The case was dismissed March 30. (Fig. 1, b.)

The patient was asked to report on the fifth day, and again on the tenth day follow-

ing extraction. On both days he reported no swelling and no discomfort. The case appeared perfectly normal for this length of time. The patient was then told not to report further unless some alarming condition arose. May 27, he reported with slight swelling in the location of the extraction. A roentgenogram was taken in a search for a sequestrum. Figure 1, c and d, (June 24) reveals dissolution of the bony structure.

At this time, it was apparent that a pathologic fracture was about to take place. The patient was treated for fracture of the jaw by wiring the mandible to the maxillae, using the normal teeth in their normal occlusion. He was then given gas anesthesia, and an external drain was inserted in the extraction

Fig. 2.—Condition July 17, 1937.

area, near the lower edge of the mandible. (Fig. 2.)

These drains (iodoform gauze, one-half inch) were changed every forty-eight hours for six weeks. Dicalcium phosphate with cod liver oil (10 grains a day) was prescribed, also all the orange juice the patient could consume (from 8 to 10 ounces a day). His physician ordered plenty of rest and sunshine and a diet of very little meat, but quantities of leafy vegetables.

July 29, gas anesthesia was again administered, and two small bony sequestra were removed from the external incision, after which healing took place rapidly.

In observing the series of roentgenograms, one notes first the destruction of bony structure, and then the gradual building up of new bone as time progresses.

The wiring was removed September 4. July 23, 1937 (Fig. 3), the patient was well

Fig. 3.—July 26, 1937.

Fig. 4.—August 26, 1938.

on the road to recovery. By August 26, 1938 (Fig. 4), recovery was complete.

603 Granite Exchange Building.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, Milwaukee, Wis., July 17-21.

American Association of Orthodontists, Kansas City, Mo., April 19-20.

American Academy of Restorative Dentistry, Milwaukee, Wis., July 15-16.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

National Board of Dental Examiners, May 1-2.

Five State Post Graduate Clinic, Washington, D. C., March 5-9.

Southwest Dental Congress, Oklahoma City, Okla., April 24-28.

Chicago Dental Society, February 13-16.

Midwinter Clinic of Dallas County Dental Society, Dallas, Texas, January 30-February 1.

Greater Philadelphia Annual Meeting, February 1-3.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June, at the United States Public Health Service Auditorium, Washington.

American Dental Society of Europe, Lausanne, Switzerland, August 7-9.

Congress of Australian Dental Association, Melbourne, August 21-26.

Southwest Dental Assistants Association, Oklahoma City, Okla., April 24-28.

STATE SOCIETIES

February

Minnesota, at Minneapolis (21-23)

March

Louisiana, at New Orleans (23-25)

April

Kentucky, at Louisville (3-5)
New Jersey, at Atlantic City (19-21)

May

Georgia, at Augusta (15-17)
New York, at New York City (9-12)
Tennessee, at Nashville (8-11)

June

Colorado, at Colorado Springs (22-24)

STATE BOARDS OF DENTAL EXAMINERS

New Jersey, June 26-July 1. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

South Dakota, at Sioux Falls, January 3-7. Carl H. Boyden, Mitchell, Secretary.

COLORADO STATE DENTAL ASSOCIATION

The Fifty-Third Annual Meeting of the Colorado State Dental Association will be held at the Broadmoor Hotel, Colorado Springs, June 22-24.

R. L. CHRISTY, *Secretary*,
820 Majestic Bldg.,
Denver.

GEORGIA DENTAL ASSOCIATION

The Seventy-First Annual Meeting of the Georgia Dental Association will be held at the Partridge Inn, Augusta, May 15-17.

R. H. MURPHY, *Secretary*,
Ga. Cas. Bldg.,
Macon.

KENTUCKY STATE DENTAL ASSOCIATION

The Seventy-Ninth Annual Meeting of the Kentucky State Dental Association will be held in the Brown Hotel, Louisville, April 3-5.

J. H. FULLENWIDER, *Secretary*,
1101 Heybrun Bldg.,
Louisville.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Indiana State Board of Dental Examiners for licensure will be held in Indianapolis beginning June 6. All applications, fees and credentials must be in the hands of the secretary not later than ten days before the beginning date of the examinations. For applications, instructions to candidates and other information, address

J. M. HALE, *Secretary*,
Mt. Vernon.

LOUISIANA STATE DENTAL SOCIETY

The Fifty-Ninth Annual Meeting of the Louisiana State Dental Society will be held at the Roosevelt Hotel, New Orleans, March 23-25.

JULIAN S. BERNHARD, *Secretary,*
417 Medical Arts Bldg.,
Shreveport.

DENTAL SOCIETY OF THE STATE OF NEW YORK

The Seventy-First Annual Meeting of the Dental Society of the State of New York will be held at the Hotel Pennsylvania, New York City, May 9-12.

GEORGE C. DOUGLASS,
80 Hanson Place,
Brooklyn.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners will hold its next session for the examination of candidates in Parts I and II, May 1-2, in schools where there are five or more candidates. For information and applications, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

CHICAGO DENTAL SOCIETY SEVENTY-FIFTH MIDWINTER MEETING

Plans are rapidly being completed for the Seventy-Fifth Annual Midwinter Meeting of the Chicago Dental Society, which is to be held at the Stevens Hotel February 13-16. More than a hundred leading members of the profession from all parts of the nation will deliver essays before the ten scientific sections.

Dentistry will be divided into ten sections and these will hold sessions during three of the four days of the meeting. Clinics will be held on thirteen different phases of dentistry and this year, in addition, it is probable that an experiment will be conducted with controlled attendance clinics. Commercial exhibits, as usual, will take up large amounts of space and many attractive displays are being planned. The scientific exhibits, which were one of the most popular attractions last year, will be increased in scope and will share attention with a special division devoted to health and educational exhibits.

The usual social events and general sessions will be held throughout the four-day meeting. Speakers of national importance, in both lay and professional fields, will be secured for the general sessions.

FREDERICK F. MOLT, *Secretary,*
25 East Washington St.,
Chicago.

SOUTHWEST DENTAL CONGRESS

The Southwest Dental Congress, Eight State Postgraduate Meeting, 180 Hours Postgraduate Study in Nine Sections, will be held in Oklahoma City, April 24-28.

HARRY H. SORRELS, *General Chairman,*
Medical Arts Bldg.,
Oklahoma City, Okla.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY IN NEW JERSEY

The State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations June 26-July 1. On application to the secretary, a copy of the requirements and rules, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25, on or before March 15 for the succeeding June examinations or before September 1 for the succeeding December examinations.

WALTER A. WILSON, *Secretary,*
148 W. State St.,
Trenton.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than twenty for appointment in the Dental Corps of the Navy will be held July 5 at the Naval Medical School, Washington, D. C., Naval Training Station Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must be submitted and approved before an applicant can be authorized to appear for examination.

Senior students in dental colleges may submit applications to appear for the examination held next after their dates of graduation. They should submit with their applications and credentials a letter from the dean of their dental school stating that they are members of the senior class and, immediately after receiving their diplomas, a letter from the dean or registrar of the dental school that they have received the degree of doctor of dental surgery or doctor of dental medicine as the case may be.

A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

AMERICAN ASSOCIATION OF ORTHODONTISTS

The Thirty-Seventh Annual Meeting of the American Association of Orthodontists will be held in Kansas City, Mo., April 17-20.

CLAUDE R. WOOD, *Secretary,*
Medical Arts Bldg.,
Knoxville, Tenn.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, REGULAR ARMY

An examination for the selection of candidates for appointment in the Dental Corps, Regular Army, will be held during the period February 13-18. The examination, which will include both physical and professional examinations, the latter consisting of written, oral and clinical tests, is open to male citizens of the United States between the ages of 22 6/12 and 31 9/12 years at the time of the examination, who are graduates of acceptable dental schools and who have had at least one year and eleven months subsequent practice in their profession.

Full information and application blanks will be furnished on request to the Adjutant General, War Department, Washington, D. C. Applications will not be considered after January 31.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held March 27 at the Hotel Belmont-Plaza, New York City. James F. Henegan, New York City, will present a paper on "The Rationale of Analgesia; A Plea for Safety." Dinner will be at 7 p.m.; scientific session, 8:30.

HARRY J. FIELD, *Secretary,*
130 Market St.,
Newark, N. J.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet July 15-16, at Milwaukee, Wis.

A. F. SCHOPPER, *Secretary,*
Professional Bldg.,
Kansas City, Mo.

SIGMA EPSILON DELTA FRATERNITY

Sigma Epsilon Fraternity will hold its annual convention at the Hotel Pennsylvania, New York City, January 8. For further information, address

DANIEL M. KOLLEN,
24 Central Park South,
New York City.

NORTHWESTERN UNIVERSITY DENTAL SCHOOL ALUMNI ASSOCIATION

The annual luncheon of the Alumni Association of Northwestern University Dental School will be held in conjunction with the Midwinter Meeting of the Chicago Dental Society at the Stevens Hotel in the Grand Ballroom, February 15 at 12 m.

GEORGE W. TEUSCHER,
311 E. Chicago Ave.,
Chicago.

AMERICAN DENTAL SOCIETY OF EUROPE

The next annual meeting of the American Dental Society of Europe will be held in Lausanne, Switzerland, August 7-9, 1939.

K. C. Campbell, *Secretary,*
88 Portland Place,
London, W. 1.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF ORAL DIAGNOSIS

It is the desire of half of the original membership of the American Association for the Advancement of Oral Diagnosis to revive it and carry on its work. The undersigned

would welcome the assistance or expression of interest of any member of the dental profession in carrying out its aims; that is, in furthering the advancement of the science of oral diagnosis. A copy of the proposed ten aims and purposes will be sent on request to any one who is interested and desires to assist.

ORVILLE S. LONG,
H. JUSTIN ROSS,
515 Madison Ave.,
New York City.

SOUTHWEST DENTAL ASSISTANTS' ASSOCIATION

The Southwest Dental Assistants Association will meet April 24-28 in Oklahoma City, Okla.

CONGRESS OF THE AUSTRALIAN DENTAL ASSOCIATION

Although Australia is geographically isolated from the other continents, in scientific and artistic thought and practice, Australian engineers, surgeons, architects, musicians, dentists, etc., are to be found in the active practice of their professions all over the civilized world. In the planning of Australian dental colleges, a large part was played by the dentists who had traveled overseas in order to obtain familiarity with the most modern views on dental education.

The respective deans of the dental faculties in the universities of Sydney and Melbourne were appointed from a field of applicants throughout the world, and the dental degrees of these institutions are recognized all over the British Empire. At the present time, the dean of the Dental Faculty of the University of Melbourne is traveling overseas to acquire a knowledge of the latest trends in all phases of dentistry. Other Australian dentists are also at present abroad, and the fruits of their studies and observations will be incorporated in the great Congress to be held in Melbourne in August, 1939. Overseas dentists will find a visit to this meeting—the tenth Australian Congress—almost equivalent to a tour of the leading dental schools of the world, many of which are sending papers and exhibits to the Congress.

W. A. MORRISON, *Chairman*,
Publicity Committee,
193 Spring St.,
Melbourne.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING NOVEMBER 1938

November 1

No. 2,134,807, to STOVER C. WINGER. Spatula.

No. 2,134,934, to JOSEPH D. WILHOIT. Dental implement.

No. 2,135,279, to FAIRLEIGH S. DICKSON and ERROL R. LAWSHE. Needle carrier for hypodermic needles.

No. 2,135,386, to LINDSAY THORNE CRABBE. Closure for containers.

No. D-111,990, to CARELL A. NEWLAND. Design for a combined sterilizing and implement holding cabinet.

November 8

No. 2,135,503, to FREDERICK E. GUNTRIP. Container.

No. 2,135,600, to CHARLES H. PRANGE. Denture.

No. 2,135,790, to HENRY F. BOEGER. Package of material.

No. 2,135,915, to FRIEDRICH SCHONBECK and HERMANN SCHRODER. Basis mass for dental repair parts.

No. 2,135,933, to JAMES H. BLAIR. Dental Instrument.

No. 2,136,033, to WALTER J. VAN ROSSEM. Dispensing package of thermoplastic material.

No. 2,136,244, to JAY A. HEIDBRINK. Absorber and rebreathing mechanism for anesthetizing machines.

No. 2,136,245, to JAY A. HEIDBRINK. Ether vaporizer.

No. 2,136,352, to PAIGE D. L'HOMMEDIEU. Appliance for dispensing dental cotton.

November 15

No. 2,136,404, to NORTON L. WHEELER. Composition for dental casting patterns.

November 29

No. 2,138,254, to SOLOMON J. MINK. Dental correlator.

No. 2,138,563, to RALPH S. VOORHEES, JR. Dental operating unit.

No. 2,138,795, to JOHN H. SCHMIDT. Composition suitable for dentures and process of preparing same.